# DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

APRIL, 1940 CIRCULATION OF THIS ISSUE—IN EXCESS OF 14,000 COPIES 25c

*Winning the Respect of Diesel Men Everywhere*

# SEALED POWER

## PISTONS, CYLINDER SLEEVES *and* LINERS

SEALED Power serves the Diesel Industry on its requirements for completely machined CYLINDER SLEEVES and LINERS, both of ordinary and High Brinell hardness. Sealed Power castings for these sleeves and liners are made both by the centrifugal and sand cast methods, and due to the unusual fine grain and dense molecular structure have far greater wear resisting qualities. They are the choice of Diesel engine builders everywhere.

Sealed Power has complete special purpose machine tool equipment for producing all types of Diesel pistons, both in cast iron and aluminum alloy.

Sealed Power chromium molybdenum electric furnace alloyed iron pistons have the acceptance where extremely severe operating conditions are required.

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**THE ACCURALITE COMPANY**
*Division of*
**SEALED POWER CORPORATION**
**MUSKEGON, MICHIGAN**


**REX W. WADMAN**
***Editor and Publisher***

FRONT COVER ILLUSTRATION: The Innis Dredging Company in Nevada City, California, is successfully operating this P & H dragline powered with a Caterpillar Diesel engine in its gold dredging operations on Deer Creek.

TABLE OF CONTENTS ILLUSTRATION: Homer Stout of Grant, Nebraska, is the proud owner of a Caterpillar Diesel tractor and triplet daughters (Barbara, Beth, and Betty, left to right), all of which appear in the above illustration.

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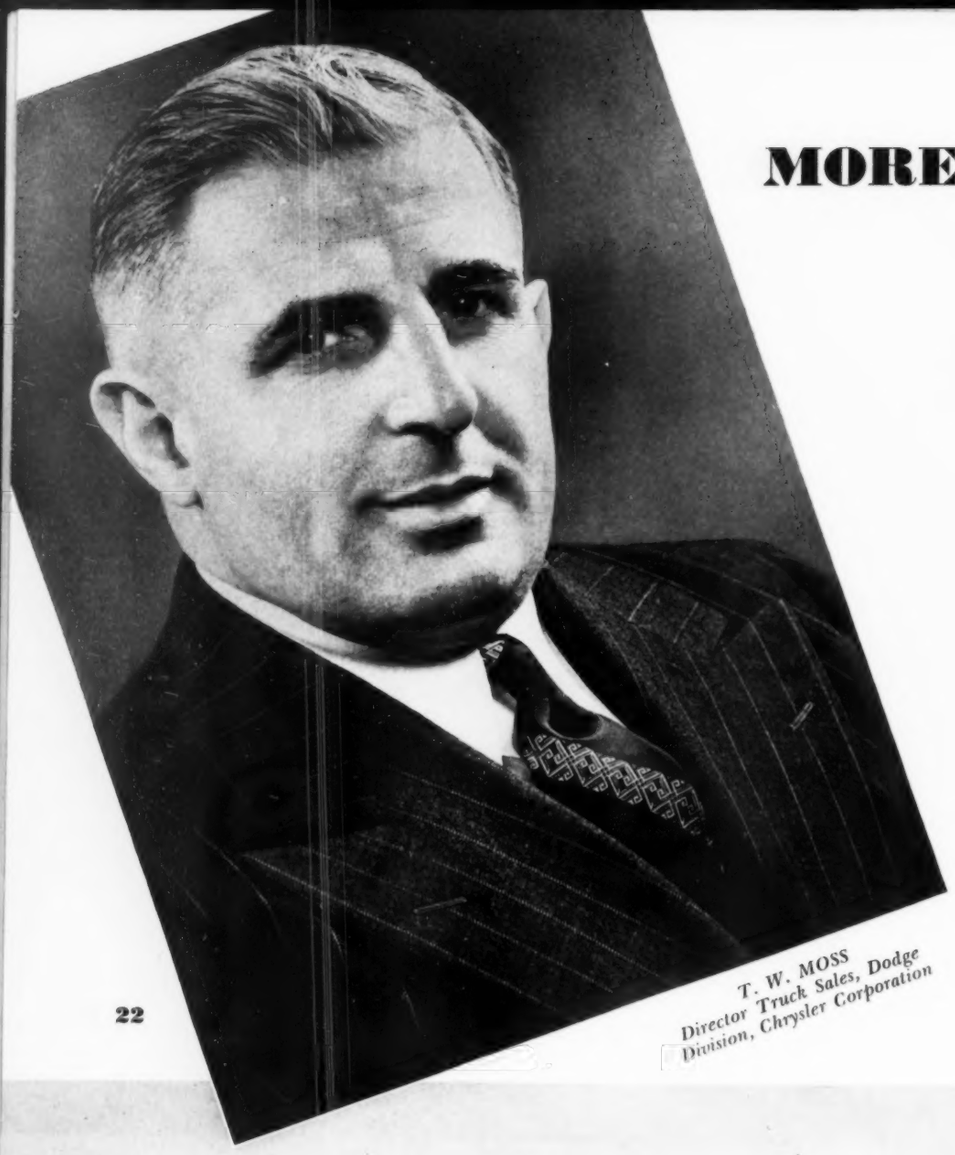
***Aviation Editor***

# CONTENTS APRIL, 1940



T. W. MOSS
Director Truck Sales, Dodge Division, Chrysler Corporation

# MORE THAN A MILLION MI
# OPERATION HAS DE

## *Says T. W. Moss, Director of Truck Sales Dodge Division, Chrysler Corporation*

"LOOKING back over a long trail of fore than a million miles of Dodge-Diesel heavy-duty truck operation brings sharply into focus many facts that are important and significant to the truck operator.

"In reviewing the million miles and more of Dodge-Diesel operation we have added up the experiences of owners and combined them with tests made by our own engineers. The following facts, very briefly stated, are the results:

"Compared with runs previously made with gasoline-powered trucks, Dodge Diesels demonstrated their superior fuel economy—with savings as high as 55% or even more, depending upon the relative costs of the fuels.

*Dodge-Diesel tractor-trailer carrying 18 tons pay load.*



# MILES OF DODGE-DIESEL TRUCK DEVELOPED SIGNIFICANT FACTS

"As much as two or three hours have been clipped from scheduled runs of 200 and 300 miles due to higher speeds on grades and faster acceleration, with consequent higher average speed for the whole run.

"Trips made in less time, or more trips over any given period, mean lowered cost for the operator whose drivers are on an hourly wage rate.

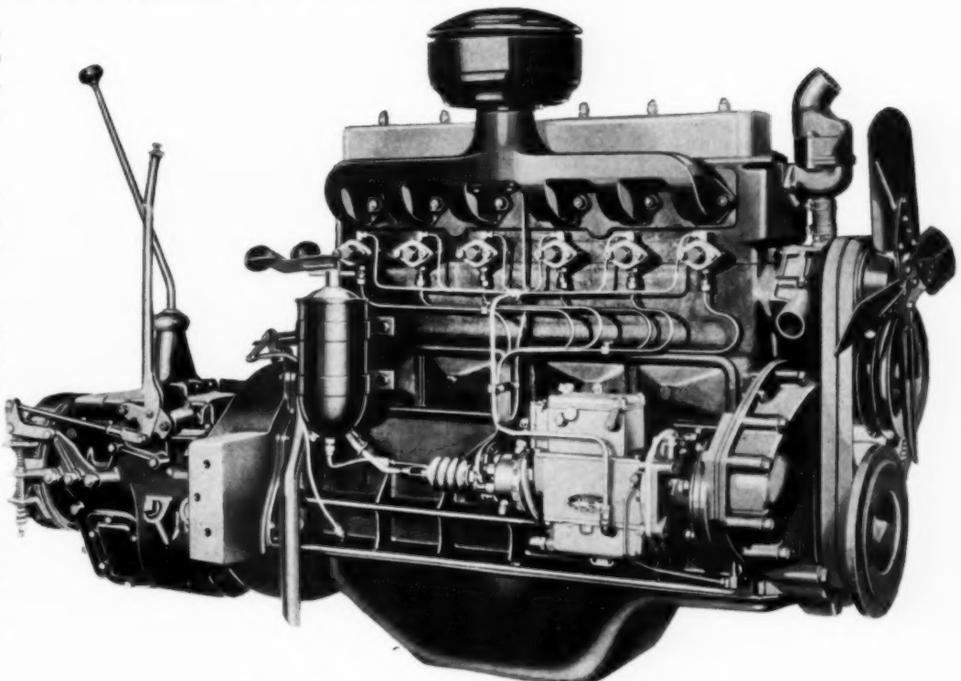
"The greatly reduced necessity for gear-shifting and the generally easier driving qualities of the Dodge-Diesel truck tend toward a marked reduction in driver fatigue—resulting in greater efficiency and contentment of drivers.

"Diesel fuel is non-volatile, presents little fire hazard. Diesel exhaust contains a very low percentage of carbon monoxide, practically eliminating the danger of exhaust gas poisoning. Less fatigued drivers are better drivers, less likely to cause or become involved in accidents.

"A well-designed Diesel is a reliable engine. Little or nothing can happen to make it suddenly stop running.

"Reduced running time and fewer causes for delay en route, enable truck owners to offer faster, better service. This is an important advantage to owners of Dodge-Diesels in a business which is highly competitive.

"Higher road speeds, particularly on grades, mean less complaint and criticism of trucks and the trucking industry by the motoring public.



*Dodge-Diesel engine, 6 cylinder, 4 cycle, 100 horsepower at 2600 r.p.m.; 240 lbs. ft. torque at 1200 to 1300 r.p.m.*

Dodge-Diesels are virtually smokeless, thus removing another objection registered against the Diesel.

"The foregoing are certainly important points for the truck operator to consider. But here at Dodge, where we make gasoline as well as Diesel-powered trucks, all of which are Job-Rated, or built to fit the hauling job they are intended to do, we feel that the choice between Diesel and gasoline power for truck transportation resolves itself almost entirely to a matter of profit and loss. Will the Diesel produce sufficient fuel savings to justify the extra initial cost? In operations where fuel bills are relatively small, a Diesel would have little opportunity to make valuable fuel savings. But in operations where fuel costs are an important factor, there is no question but that the Dodge-Diesel can show an important savings."

*Hillside Garage & Transit Co. writes, "Our Dodge-Diesel trucks outperform our best gasoline units of comparable capacity, although the fuel costs are only half as much."*

# SOUND PROGRESS ACHIEVED AS EARLY
# REPLACED BY ORDERL


*One of the modern Twin Coach buses powered with a Hercules Diesel engine.*

## *Says Charles Balough, President, Hercules Motor Corporation*

*[Editor's Note: "The tumult and the shouting dies"—and the modern Diesel Engine emerges from the dust, confusion and clamor of a hectic start into the "straightaway" of wide public acceptance as an important tool of industry. That, in brief, is the Diesel picture today as viewed by Mr. Balough from his vantage point as a pioneer in the modernization of the Diesel and as president of Hercules Motors Corporation, world's largest manufacturer specializing in the design and construction of high-speed, heavy-duty Gasoline and Diesel engines, exclusively.]*

"MORE interesting and perhaps more significant than the sales totals of Diesel horsepower during the past year, impressive as they are, is the fact that Diesel Engines are now being sold, and purchased, on a far more intelligent basis than they were a few years ago.

"It was, of course, to be expected that with the development of relatively small, compact and performance-worthy high-speed Diesels, a wave of enthusiasm—and exaggerated promises of 'efficiency and economy'—would sweep the power-using world. Comparative fuel cost figures caused many to believe that nothing short of a 'power revolution' was imminent.

"Certainly the advent of the high-speed, heavy-duty Diesel enjoyed what English writers term 'a good press'. And while no predictions were openly made that spark-plugs would soon become collectors' items, many ardent enthusiasts were undoubtedly so sincere in their devotion to the manifest economies of fuel-oil operation that other significant factors in the power picture generally were minimized in importance or overlooked entirely.

"As is of course well known, properly-designed, quality-built and performance-proven Diesels are pre-eminently satisfactory in an impressive range of applications. New markets for the profitable utilization of Diesel engines are developing steadily. And with the increasing application of *sound sense* in Diesel engine selection—with the growing realization that with all of its unquestioned advantages the Diesel is not necessarily a cure-all for power problems, nor a 'prodigy' of strength and performance—but rather a tool that will render profitable and highly satisfactory service *when properly selected for the job to be done*—the successful develop-

# OVER-ENTHUSIASTIC SELLING IS MARKETING METHODS

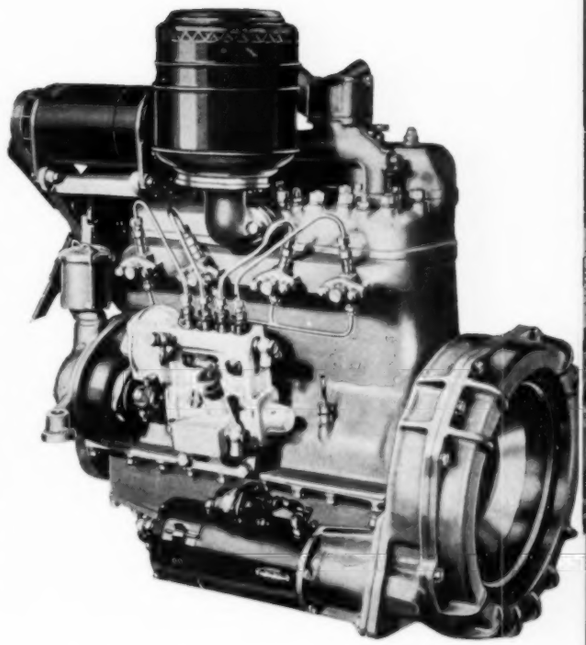
ment of an important industry becomes an assured fact.

"As evidence of Diesel engine progress, more Diesel engines were sold in 1939 than during any previous years. Diesels were bought for a greater variety of applications. Performance records of earlier applications pointed clearly to consistent fuel-cost economies and increasingly better standards of service.

"Important Diesel gains were made in the bus field as well as in the truck industry. In commercial vehicle fields, the prediction made a year or so ago that the smaller type of high-speed, heavy-duty Diesel would be an important factor in highway transportation, is proving to be well founded. A very healthy demand has developed since the introduction of the Hercules 'Power Package' Diesel, Replacement Engine for Ford Trucks and sales of this unit have shown steady improvement month by month. Increased use of this Diesel by Ford Motor Company, in chassis for export shipment, is also to be noted.

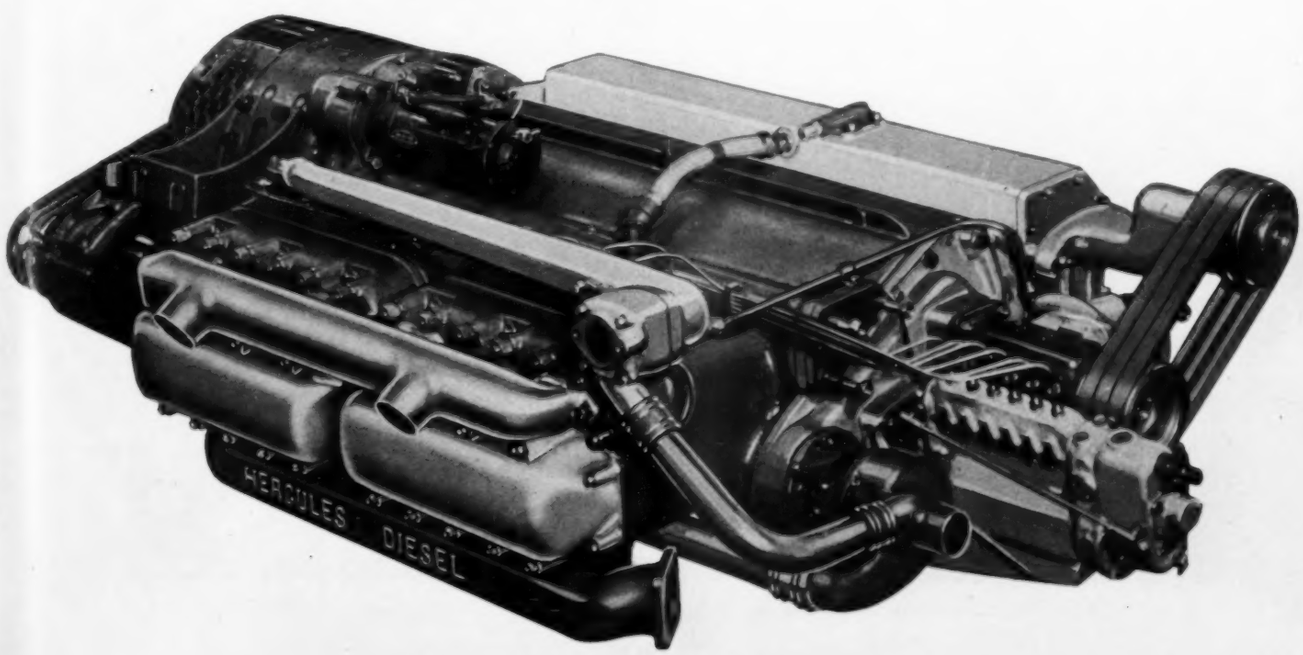
"Following out the Hercules policy of developing Diesel Engine models for markets of promising expansion, Hercules added a new Series in 1939 which has been well received. The DFX Series of 'pancake type' engines (5" x 6", 5¼" x 6", 5½" x 6"), in horizontal, vertical and on-the-angle models, is being adopted by bus and rail car manufacturers as well as for air-conditioning applications for trains and buses.

"In closing, let me repeat that the future of the Diesel engine industry looks bright indeed, now that orderly marketing methods are replacing misguided enthusiasm and high-pressure selling. The most hopeful sign is that manufacturers, engineers, and power users are co-operating closely to the end that the selection of a Diesel engine, as any other importatn purchase, be made with proper consideration of all factors entering into the transaction."

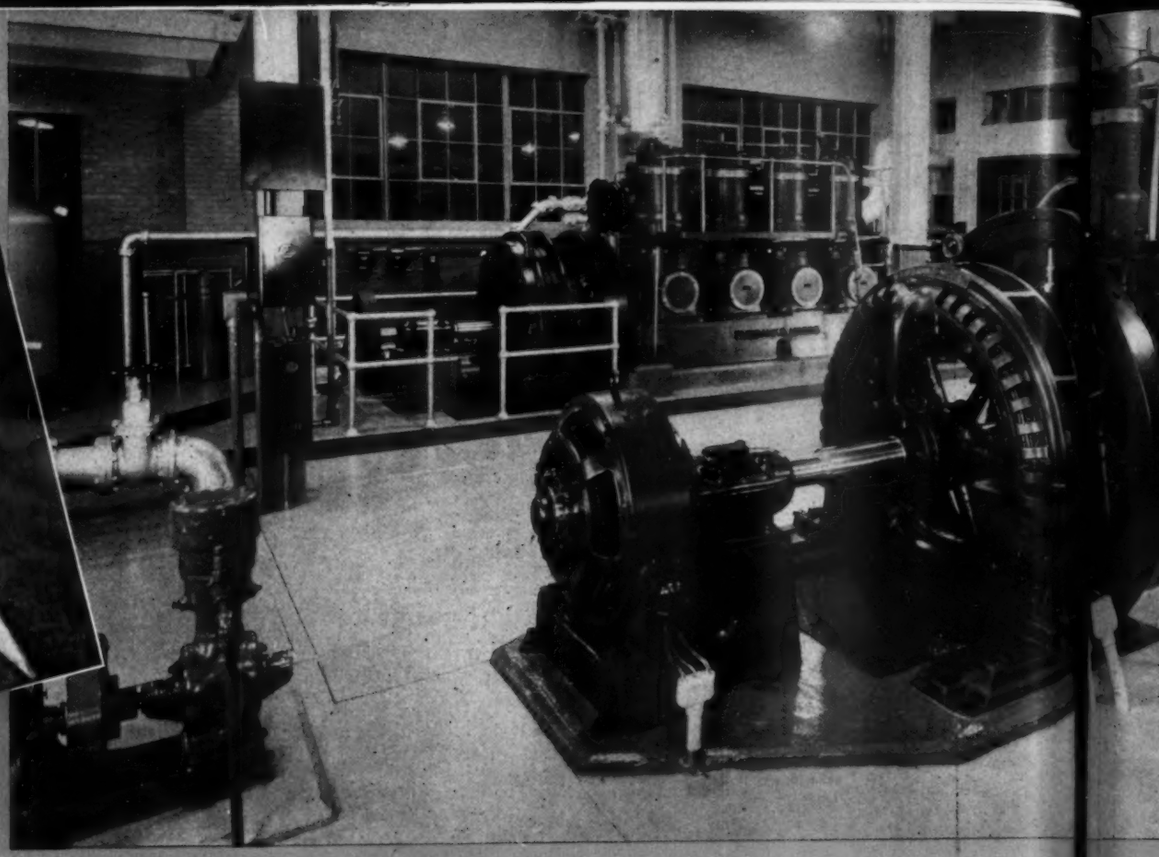


↑*Hercules Diesel engine replacement for Ford trucks.*

*Horizontal 6-cylinder Hercules Series DFX Diesel called the "Pancake" type, widely used in bus service.*

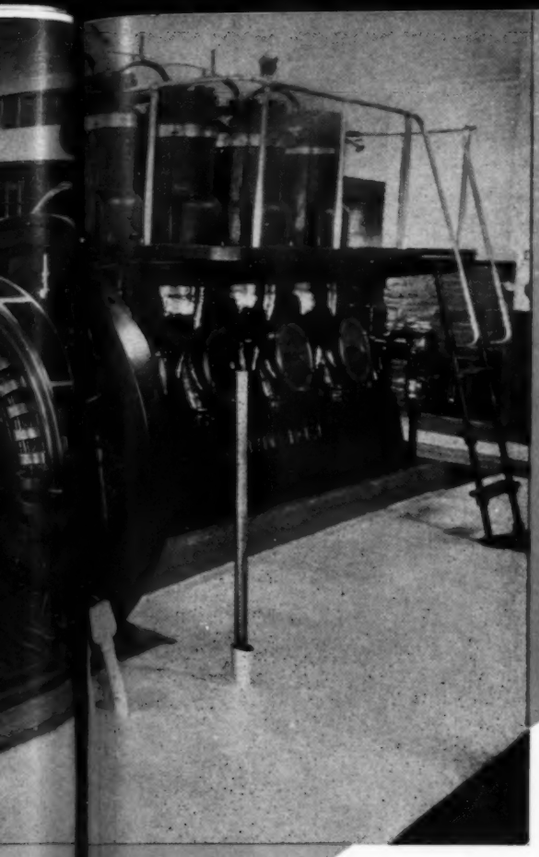


*A. C. Dodge, Vice-President and General Sales Manager, Fairbanks, Morse & Co.*



*General interior view of the Municipal Diesel Power Plant, Middletown, Delaware.*

*Exterior view of the Middletown, Delaware, Municipal Diesel Plant.*



# DIESELS PAY DIVIDENDS TO SMALL, AS WELL AS LARGE MUNICIPALITIES

## *Says A. C. Dodge, Vice-President and General Sales Manager, Fairbanks, Morse & Co.*

[*Editors' Note: The editors of* DIESEL PROGRESS *maintain close contact with every major Diesel installation that news of technical interest, performance, and operating data may be presented to readers. The industry, however, is not made up of engines alone. There are some outstanding personalities, men who have contributed much to the progress of the Diesel industry, and whose achievements make them worthy of introduction in our pages. Among these is Mr. A. C. Dodge, Vice-President and General Sales Manager of Fairbanks, Morse & Co., who tells us in a detailed fashion of one city's experience with Diesels.*]

"WE hear much in the daily press of the municipal affairs of the big cities," said Mr. Dodge. "But the fact remains that more Americans live in cities of from 1,000 to 10,000 population than live in all the cities of 500,000 or over, combined. Consequently, civic benefits assume greater importance when they are affected in the smaller cities.

" 'Diesel dividends' is a phrase with very definite and tangible meaning to such cities and towns," continued Mr. Dodge. "It means lower taxes, lower industrial, commercial, and domestic rates with attendant improvement in business and social conditions.

"Middletown, Delaware, is a typical example. Located about 25 miles south of Wilmington on the main highway between that town and Del-Mar-Va Peninsula, Middletown is an average American community of about 1400 people. But in one respect it is far above the average — and that is its municipally-owned power and water pumping plant which is conceded to be one of the most modern and efficient of its kind in the country. The history of this plant emphasizes the fact that well engineered and well managed municipal plants do pay dividends to the citizens who own them.

"For many years, Middletown has operated its own power and water service. As far back as 1924, officials of the town realized the advantages of low-cost Diesel engine power and installed two 120-horsepower Model 32 Fairbanks-Morse Diesels, both direct connected to two alternators of the same make.

"Within three and a half years, demand for power necessitated doubling the capacity of this plant, and again one of our engines was selected. This time, a 240-horsepower size.

"Power requirements still continued to increase, and again in 1938 Middletown decided to further add a 300 hp. unit and replace some of the obsolete pumping equipment. Financing for the additions was negotiated through P.W.A., and Albright & Friel, consulting engineers of Philadelphia, were retained to plan the improvements and additions.

"Two contracts were let for improvements and additions to the Diesel plant. The first covered modernizing one of the Diesels, the 240-hp. already installed. The other contract called for the new 300-hp. Fairbanks-Morse Diesel with direct connected 250 KVA alternator designed to parallel with the existing generating equipment. According to the superintendent of the plant, the modernization job resulted in a substantial saving in fuel cost per kwh. — plus improved operation.

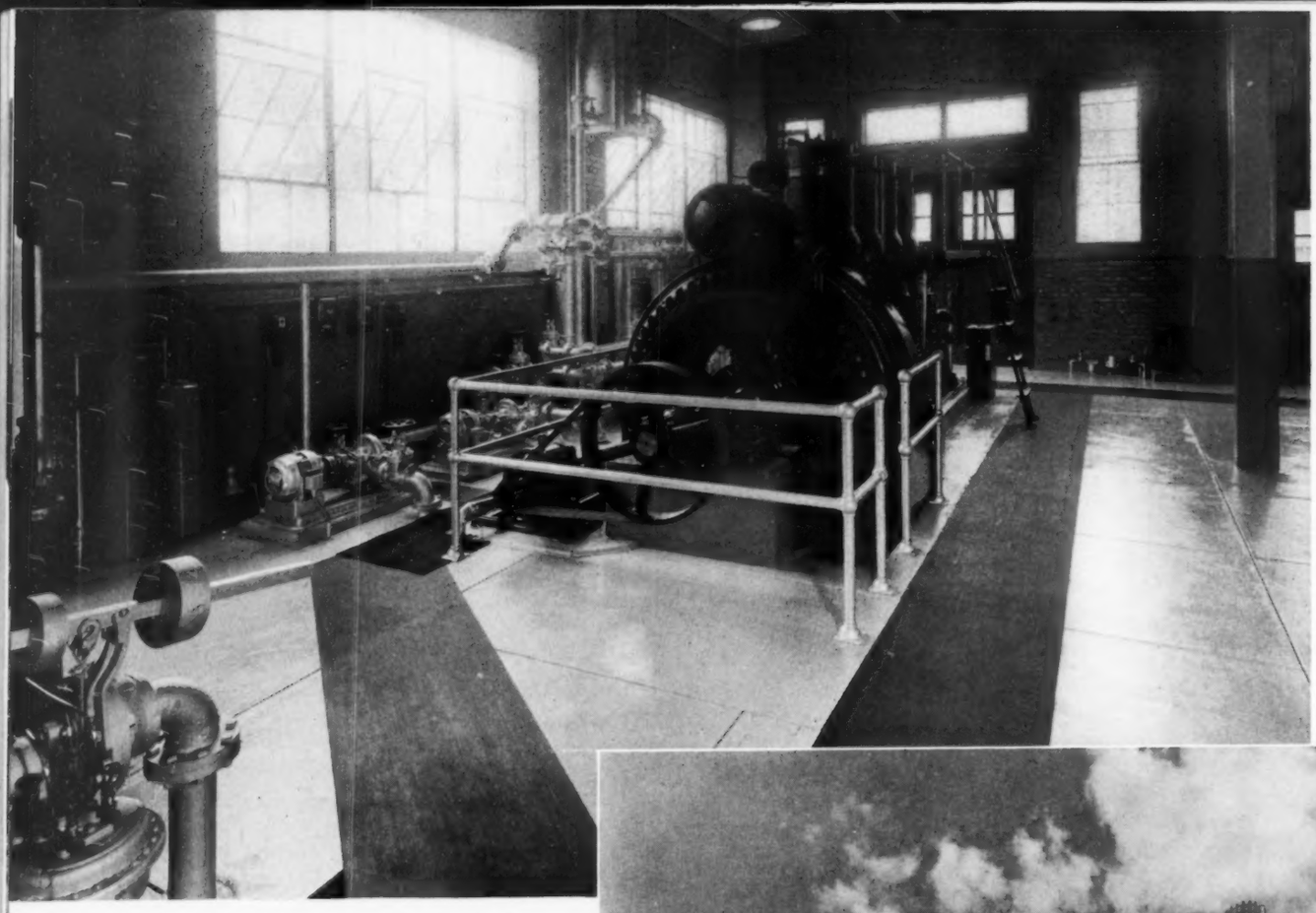
"Fairbanks-Morse is and always has been an exponent of the heavy-duty, slow-speed, two-cycle, Diesel for heavy-duty jobs," says Mr. Dodge, "largely for the same reason that a farmer hitches a work horse to a plow — and not a race horse. Where operation is continuous, we believe the two-cycle, slow-speed Diesel is much better suited to the job because of its fewer moving parts and the absence of accelerated wear on those parts. The Middletown power and pumping plant is typical of this type of installation. Furthermore, we are naturally proud of the fact that the latest Diesel purchased by this municipality is the fourth of our make.

"In August of 1939 the new 300-hp. generating unit was installed and had operated 2200 hours by February of this year. The operating record shows an average of 12,81 kw. hr. per gallon of fuel. The Federal Power Commission has recently released figures showing that Middletown has the lowest rates for a city of its class in the state. The net operating profits of the Light and Water System (water system also Fairbanks-Morse equipped) was $14,500 last year.

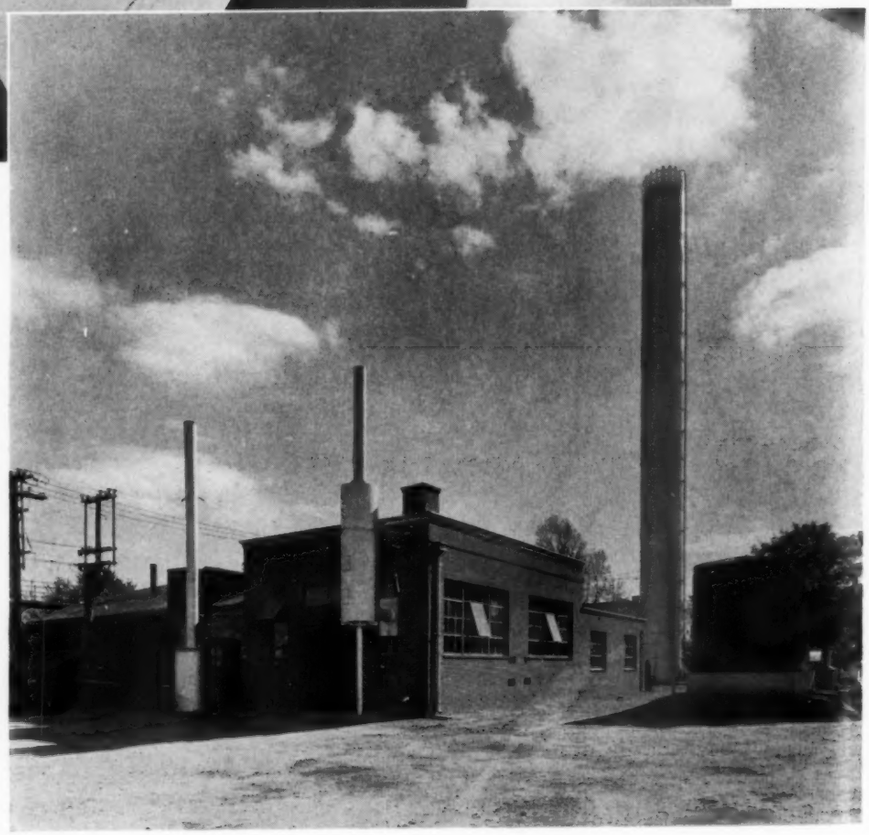
"In line with our policy of bringing, wherever possible, the advantages of new developments to engines already in service, the modernization of the 240-hp. Diesel has met the unqualified approval of the city officials. This engine and generating unit is carrying its rated load with a reduction of one-third in fuel consumption.

"We acted as contractors on this job for engines, generators, control equipment, all auxiliaries, erection and construction. This undivided responsibility is not only efficient but affords a protection to the city.

"Middletown is typical," concluded Mr. Dodge. "Cities of small and medium size are finding the answer to financial and tax problems by installing Diesel driven light and power plants. We are now in a period where the number of such cities is growing rapidly."



*The four-cylinder, 300-hp. Fairbanks, Morse Diesel—the latest addition to the Middletown Plant.*



*Exterior of the plant, showing Maxim silencers and Marley cooling tower.*

The latest addition to the Middletown plant is a 300-hp., 4-cylinder, Model 32E, 14 x 17 Fairbanks-Morse Diesel Engine. The engine is directly connected to a 250 KVA-200 KW at 80 per cent P.F., 3 phase, 60 cycle, 2,400 volt alternator, Fairbanks-Morse, with V-belt driven exciter. The alternator is designed to parallel with all of the existing machinery. The engine is fitted with Alnor pyrometer equipment; Maxim No. 24, 12 in. Model MU2 exhaust silencer with side inlet, this silencer connected to the water-cooled exhaust manifold and set outside of the building.

The cooling system is supplied initially from the water main, water being introduced into the surge tank of the indirect system through a Permutit water softener, the make-up being controlled by a float valve in the surge tank. There are two Fairbanks-Morse motor-driven pumps for soft water and two for raw water. There are also two Schutte & Koerting heat exchangers. The soft water system is interconnected between the 300-hp. and the rebuilt 240-hp. engines and cross connections were made, so that if necessary, on account of difficulty with the soft water pumps, the raw water pumps could be swung over to act as soft water pumps, in which case connections are also made so that the city water could be used temporarily as raw water.

The secondary or raw water system normally forces the water through headers to the heat exchangers and from them to a Marley atmospheric cooling tower set outside the building above a concrete base.

The switchboard was enlarged and changed to permit parallel operation of the new and the old units and a new Westinghouse Silverstat voltage regulator was supplied for the new unit. Perfect paralleling is accomplished with remote control of the governors from the switchboard.

# DIESEL PAK-ICE UNIT

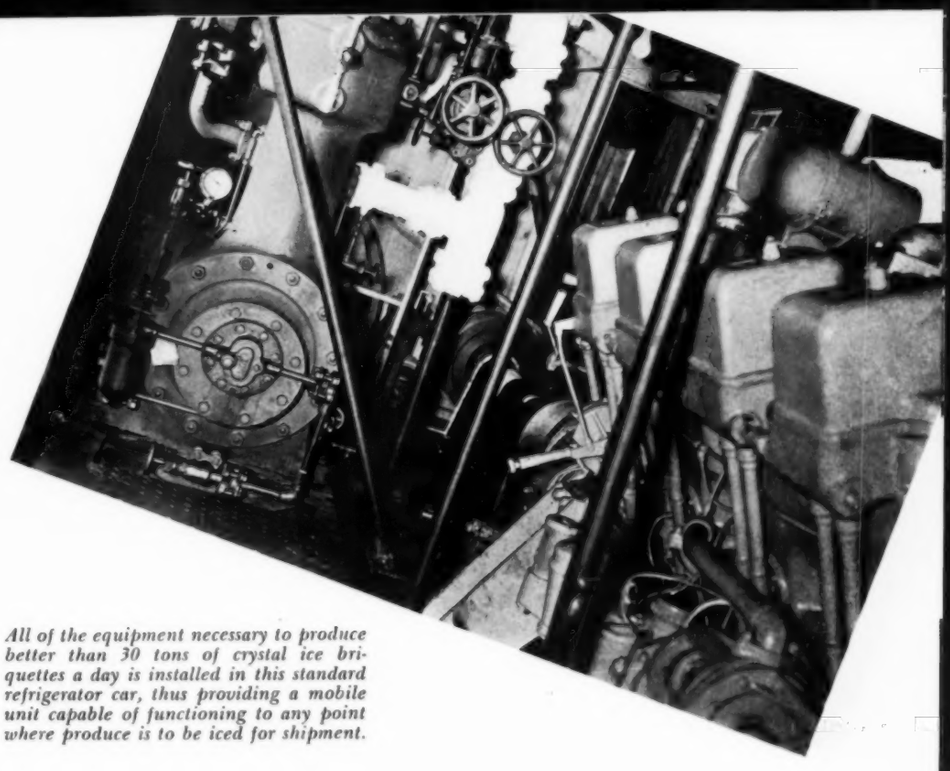
*By* JOHN E. HUBEL

PRODUCING ice crystals and forming them into briquettes within the confines of a standard refrigerator type railroad car is a new and unusual job for the versatile Diesel engine. The definite requirements of a power unit in this application are compactness, dependability, self-sufficiency and low operating cost because the entire equipment is installed in a single rail car which is moved to any point where vegetables are to be loaded and iced for shipment. The only outside connection to the car is a water hose to supply make-up water for the freezing unit.

This mobile Pak-Ice unit is driven by a Caterpillar V-type 160 hp. Diesel engine driving a line shaft to the ammonia compressor, Pak-Ice freezer and briquette press, also a 15 kw. generator for lighting and auxiliary electric motors.

The ice making equipment consists of a Pak-Ice freezer which is a double-walled cylinder, a series of ice-cutting knives and a water circulating pump. The inner cylinder is grooved to present the maximum freezing surface. Ammonia is evaporated in the annular space between the cylinders, thus causing the inner cylinder to become a direct expansion freezer. The inner shell is filled with recirculated water from which a thin film of ice is formed in the grooves. Rotating knives cut the ice from the cylinder wall in the form of crystals .003 in. in diameter which are carried to the briquette press by the circulating water. Here, under tremendous pressure, briquettes weighing about 24 oz. each are formed. These are used for icing the bunkers in refrigerator cars, for top icing on vegetables and some are crushed and blown over the produce.

It will be seen that self-sufficiency and dependability are indeed definite musts for this unit since produce has to be preserved, often in isolated locations. Low cost production of ice under these conditions is even more essential and here are figures which show that the Diesel engine is well within operating cost limits.

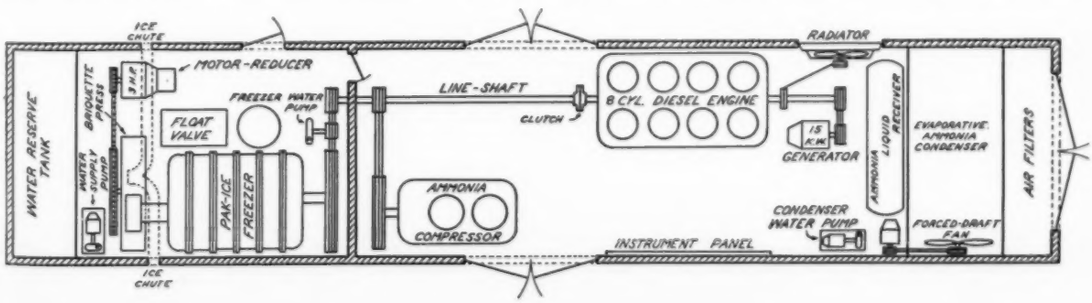



*All of the equipment necessary to produce better than 30 tons of crystal ice briquettes a day is installed in this standard refrigerator car, thus providing a mobile unit capable of functioning to any point where produce is to be iced for shipment.*

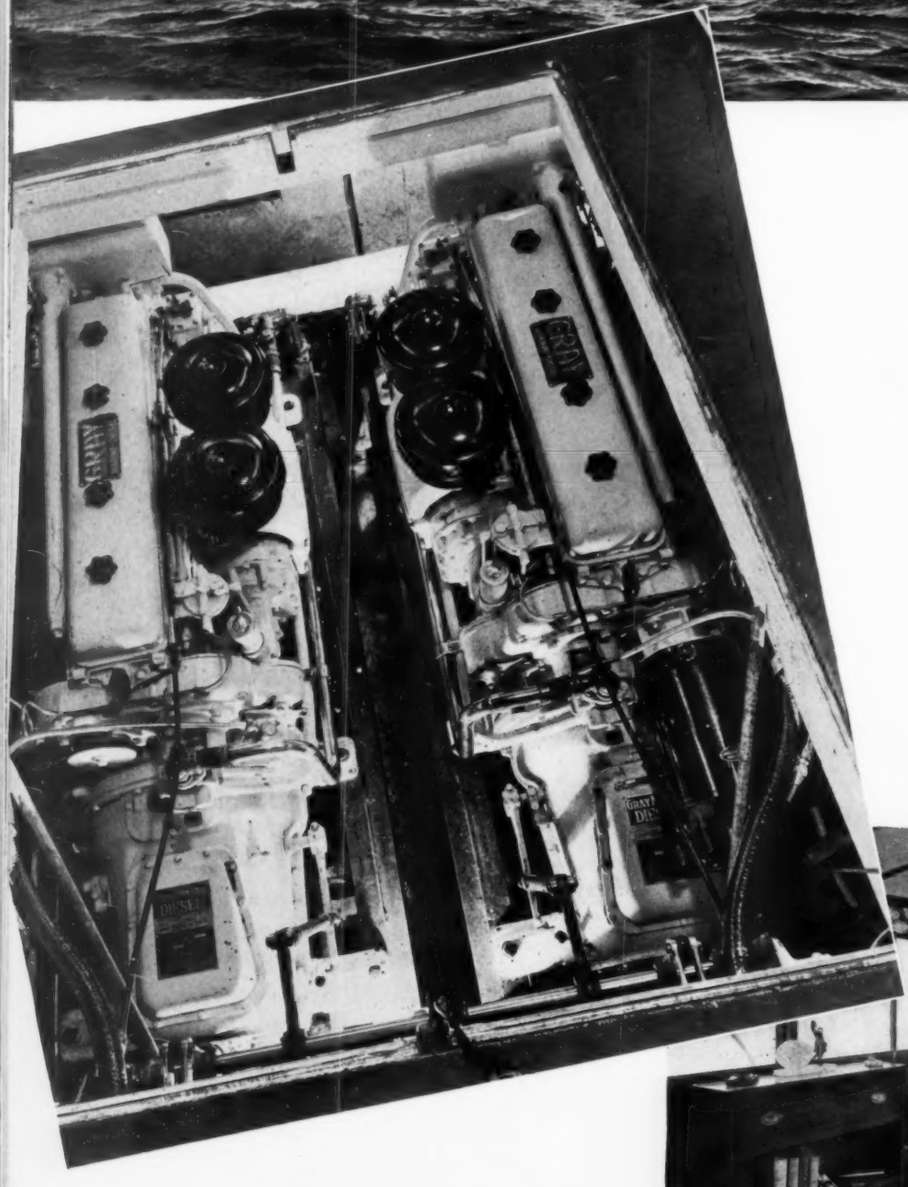
| | *Producing Hours per Week* | | | |
|---|---|---|---|---|
| *Cost per Ton* | *60* | *84* | *120* | *156* |
| Fixed Charges ... | $ .66 | $ .471 | $ .330 | $ .254 |
| Maintenance .... | .082 | .079 | .069 | .063 |
| Operating Labor.. | .51 | .502 | .471 | .469 |
| Lube Oil ..... | .104 | .104 | .104 | .104 |
| Water ..... | .03 | .03 | .03 | .03 |
| Fuel Oil ..... | .338 | .338 | .338 | .338 |
| Total cost per ton | $1.724 | $1.524 | $1.342 | $1.258 |

The above figures were developed from an overall efficiency test, conducted by A. C. Nielson Co., which also showed the plant capable of producing 1.3496 tons of ice per hour or 32.39 in 24 hours. This test proved the plant capable of continuous performance over long periods at somewhat above rated capacity since the ammonia compressor and freezing unit are rated at 30 tons capacity per 24 hours.

So again the Diesel engine moves into a job to which its characteristics are perfectly suited and where other forms of motive power would fail on one or more counts.

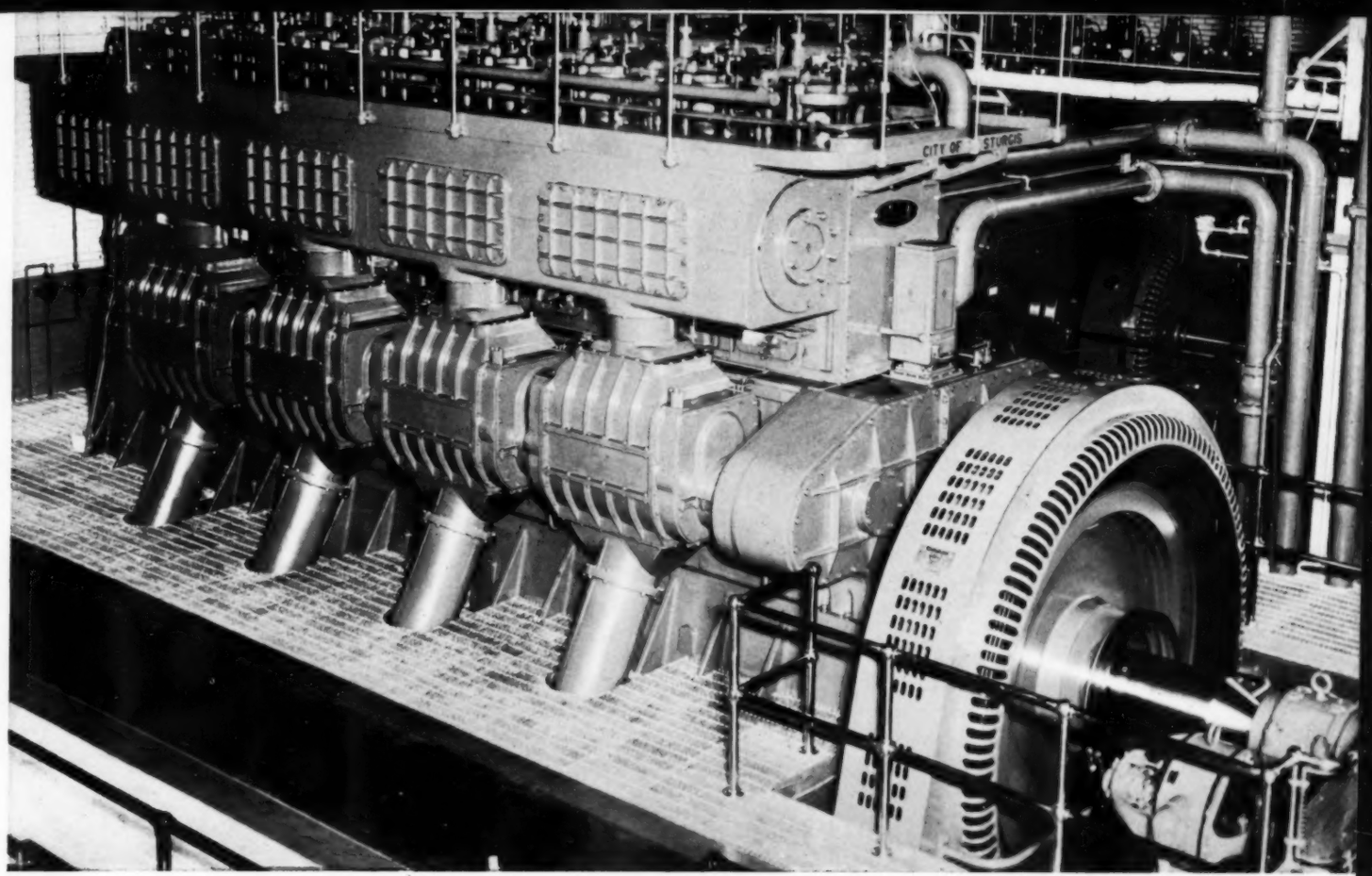



*Plan of the arrangement of machinery within the rail car. The Caterpillar Diesel furnished power for the freezing and briquetting machines as well as electrical energy for lighting and motors.*



# NEW ELCO-57 DIESEL YACHT

*The 57-foot Elco Diesel yacht, new flagship of the 1940 fleet, with clipper bow is conservatively streamlined in appearance. Of particular interest is the manner in which the windshield of the deck saloon, the flying bridge on which the controls are located, and the after deck shelter are attractively raked. This new Diesel yacht has an overall length of 57 ft. 9 in. and a beam of 14 ft. 9 in. She is powered with a pair of Gray marine Diesels, the Diesel engines built by General Motors and adapted for marine use by Gray Marine Motor Co. Each engine develops 165 hp., giving the boat a top speed of 19 mph.*




*The new 2,475 hp. Busch-Sulzer Diesel and Westinghouse alternator. Note the four Roots blower housings below the scavenging air header.*

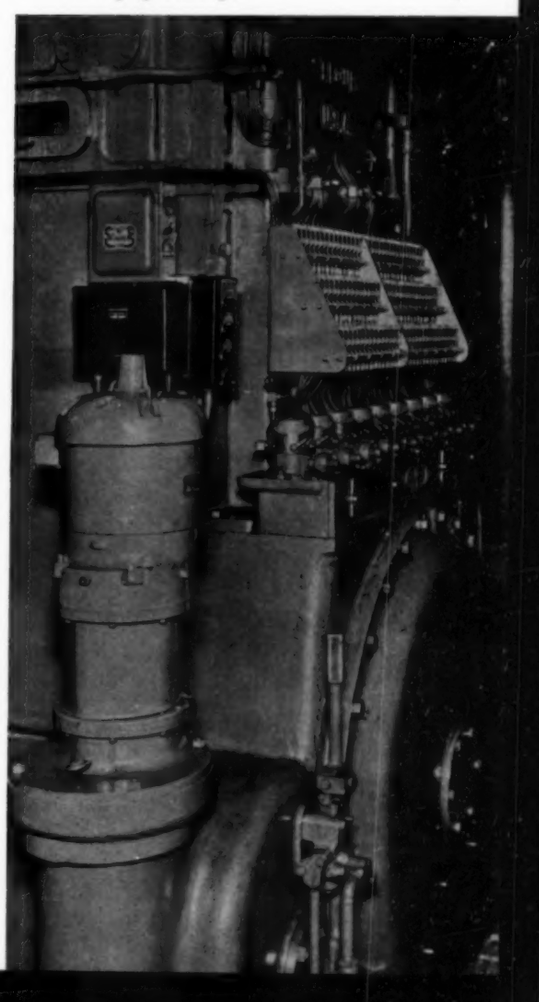
*This nine point, ninety-six feed Nathan mechanical lubricator supplies force-feed lubrication to the Diesel pistons and scavenging bearings.*

# STURGIS, MICHIGAN

*By* R. D. CAMPBELL and J. J. THRELFALL*

THE new 2,475 hp. Busch-Sulzer Diesel engine, which was placed in operation in December, 1939, is the third Diesel engine in the Sturgis Municipal power plant. The city has owned and operated its own utilities for over forty years, but until 1936 two 550 kw. hydro turbines provided ample power. When it became evident that a new source of power was necessary to keep pace with the growing power load, it was decided to adopt Diesel engines. Two 5 cylinder, 15⅛ in. x 21 in., 2 stroke cycle, 300 rpm., 875 hp., type 5SE21, pump scavenging Busch-Sulzer Diesels were installed. Each of these engines was direct connected to a 750 kva., 600 kw., 3 phase, 60 cycle, 2,400 volt General Electric Alternator with 15 kw., V-belt driven exciters. The economical performance of these engines over a three year period led to the selection of a third Diesel, the new unit, when additional power was required.

The new unit is a 2,475 hp., 2 cycle, type 8DHB, Busch-Sulzer Diesel with eight 20½ in. x 27½ in. cylinders operating at 240 rpm. It is direct connected to a 2,188 kva., 1,750 kw., 3 phase, 60 cycle, 2,400 volt Westinghouse Alternator with a V-belt driven 25 kw., 1,150 rpm., shunt wound Westinghouse exciter. The engine is of the same type and cylinder size as is being supplied by Busch-Sulzer to the Maritime Commission for use in the class C-1 and C-3 ships. The *Moormacpenn*, described in the February issue of DIESEL PROGRESS, is



*Chief Engineer, Sturgis Municipal Water and Light Plant.

equipped with four of these engines. The Sturgis engine is rated on the very conservative basis of 56.25 pounds brake mean effective pressure.

The new engine is equipped with Deco fuel injectors and American Hammered piston rings. A small instrument panel on the control side of the engine includes thermometers and pressure gauges for the raw and soft water circuits, lubricating oil system, starting air, and scavenging air. Each cylinder is equipped with an individual thermometer indicating the jacket water outlet temperature.

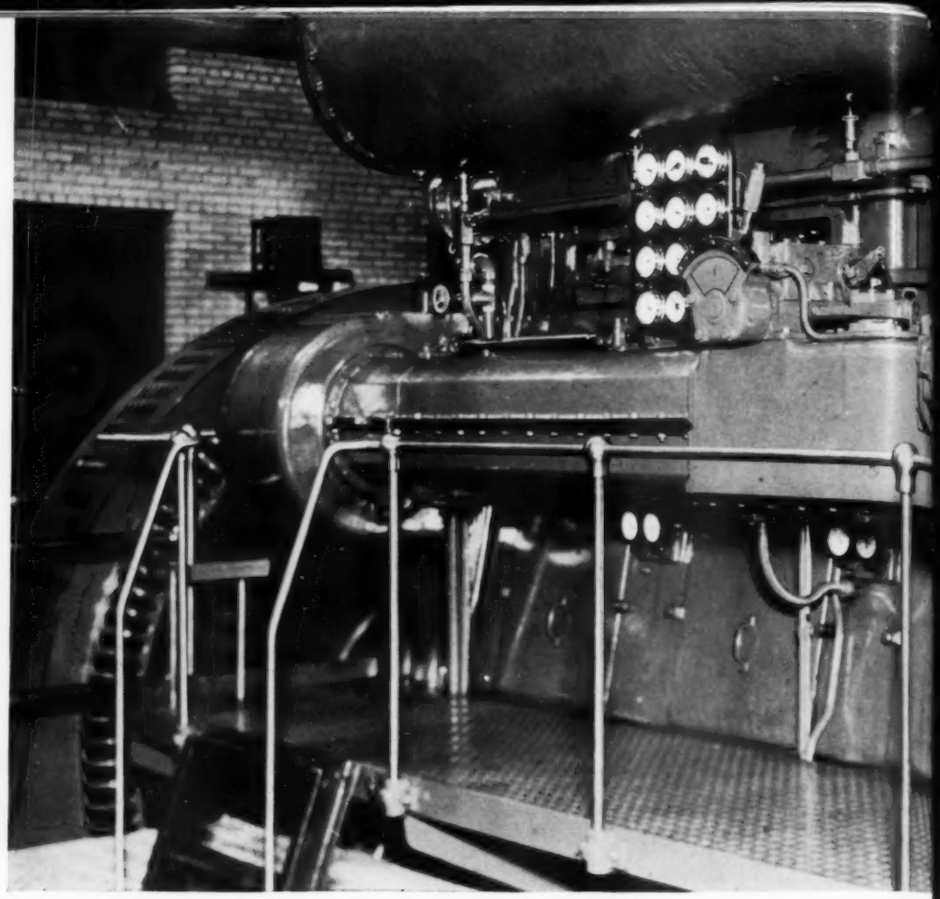
The air intake and exhaust silencers rest atop a concrete chamber used to house the air filter cells. The air is drawn in through Burgess silencer to the filter house where it passes through a battery of twenty American Air Filter Cells. From the filter house the air is carried into the basement of the engine room along side the engine foundation and upward to each of the scavenging blowers. The exhaust leaves the engine on the control side and is carried out to the Burgess Exhaust Snubber standing along side the air intake silencer atop the air filter house.

The fuel oil used in the plant is a Michigan distillate having a specific gravity of 34-36 Baume.

There are two fuel storage tanks: one of 22,000 gallon capacty, which is located underground, and one of 15,000 gallon capacity, located above the ground.

The fuel oil flows from the storage tanks to the engine room basement by gravity. At this point the fuel is centrifuged and filtered and returned to a clean fuel supply tank from which the engine day tanks are filled. There are three 250 gallon overhead day tanks located in the engine room at a point well above the engines.

The engine is cooled by an indirect cooling system, using treated water in both the engine jacket and cooling tower circuits. The use of treated water in the cooling tower circuit was necessitated by the excessive scale and deposits formed in the tubes of the heat exchanger. The plant equipment includes three Zeolite type water softeners of 1,500, 5,000, and 10,000 gallons capacity per charge. The small softener was originally installed to handle the water for the engine jackets when the first Diesels were installed in 1936. The two larger softeners were installed at a later date when it was decided to treat the water for the cooling tower.



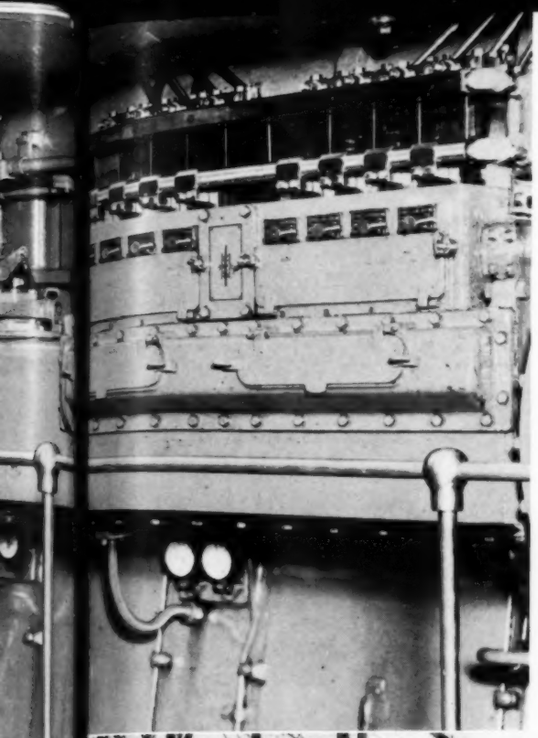
*View of control side of the new Busch-Sulzer Diesel at Sturgis, Michigan. Note Deco fuel pumps, right center.*

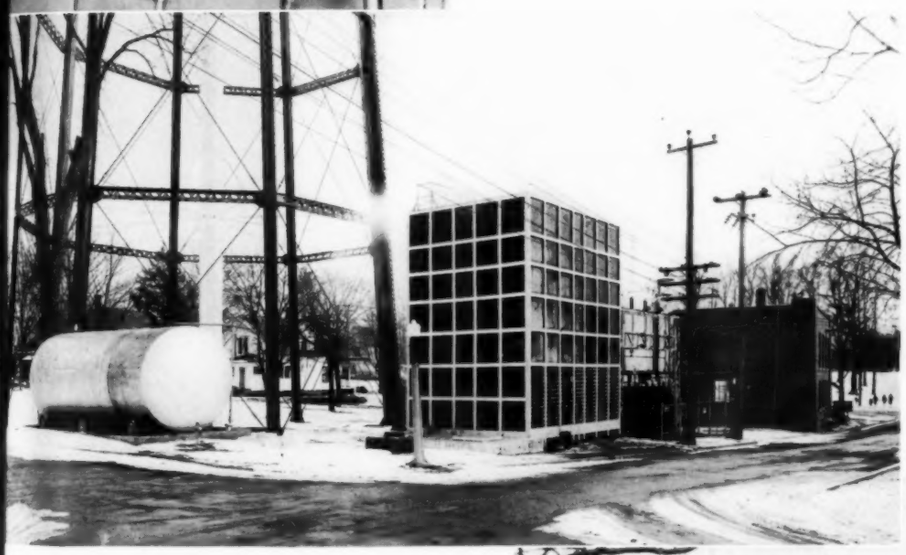
The recently completed program of plant improvements included the erection of a type 2-ID-830 Schubert-Christy 2-cell induced draft type of cooling tower. The tower measures 26 ft. x 14 ft. 6 in. x 28 ft. high, and is used to cool the water for all three Diesel engines now in the plant. The tower is equipped with two 103 in. 6 blade, adjustable pitch, propeller type fans, each driven by a 7½ hp. General Electric motor.

The two smaller engines are equipped with their own heat exchangers and cooling water pumps. The new unit is equipped with an entirely separate cooling system, consisting of three Dayton-Dowd 4 in. double-suction, type 4CSLH centrifugal pumps and a Ross heat exchanger. Each of the pumps is direct connected to a 15 hp., 1,750 rpm. General Electric Induction motor, and is rated to deliver 500 gallons of water per minute against a total head of 70 feet. While only two of the pumps are needed at any one time, one for the engine jacket circuit and one for the cooling tower circuit, the pumps are inter-connected to both the soft and raw water headers so that any one of the pumps may handle either circuit. This arrangement allows for the removal from service of any one pump without interrupting the engine cooling function. The joints of the cooling water system are all welded and the fittings are of the streamlined type. These factors reduce the friction losses in the pipe and provide a neat and substantial appearance.

The starting air equipment for the new unit consists of a Worthington 2-stage, air-cooled, type VA2HM8 compressor driven by a 5 hp. General Electric motor. The air is stored in three 36 in. x 120 in. welded steel air tanks designed for a working pressure of 250 pounds. The adequacy of air starting system is evidenced by the fact that the new engine was started eleven times from the air in only one of the tanks.

The new engine embodies a number of features and new developments, the most obvious of which is the battery of Roots type rotary blowers used to scavenge the cylinders. Instead of the conventional type reciprocating air pump, the engine is equipped with four blowers arranged axially along the back side of the engine and driven by a common shaft





*Above: View showing 15,000 fuel storage tank and the new Schubert-Christy cooling tower. Right: General view of the Sturgis, Mich., Municipal Water and Light Plant,*

geared to the crankshaft at the flywheel end of the engine. The cylinders are scavenged through inlet ports arranged in two tiers or rows, each of which extends half way around the circumference of the cylinder. The lower tier of ports is located opposite the lower half of the exhaust ports, and is open for only a brief period when the piston is near the lower dead center position. By the time the piston uncovers the lower tier of ports, the pressure within the cylinder is below the pressure of the air in the header. The upper tier of ports extends above the level of the exhaust ports, but the flow of air into the cylinder through these openings is controlled by Sulzer type scavenging valves.

The engine barring device consists of a motor driven worm and spur gear-reduction train which meshes with a large spur gear on the crankshaft. A 1½ hp., 1,730 rpm. Master electric motor supplies the power to the barring device, and is arranged with push button control for forward or reverse operation. Before using the barring device, a lever-controlled gear must be meshed with the gear train, and this same gear must be disengaged before air can be applied to the cylinders. The interlocking of the barring gear engaging lever with the starting air precludes the possibility of damage resulting from turning the engine with air when the motor driven device is in gear.

A circulating system supplies lubricating oil to the main bearings, connecting-rod bearings, all moving parts inside the crankcase, and to the piston for cooling purposes. The piston cooling oil is delivered to the piston and removed from it by means of "trombone" or slip-joint connections.

The working pistons and blowers are lubricated by a force-feed system consisting of nine valveless Nathan mechanical lubricators each having from 9 to 11 outlets, totaling 96 feeds to various points. The Nathan lubricators are ratchet driven and are supplied with oil from a common reservoir located above the lubricators. The lubricator sight feeds are positioned immediately above the lubricators in their discharge lines and at a level convenient to eye of the operator. A motor driven auxilliary lubricating oil pump is used to circulate the oil in the pressure system before the engine is started, and is used to circulate the oil and cool the pistons after the engine is stopped. While the engine is in operation the oil is circulated by a built-in circulating pump.

A control and alarm panel for the new unit is located directly in front of the control side of the engine and includes: An Alnor Pyrometer; alarms for low pressure on the lube oil, cooling water and starting air pressures and high cooling water temperature; push button controls for each of the three water pumps, each of the cooling tower draft fans, the auxilliary lube oil priming pump, and the fuel oil booster pump.

*General view of the truck highway from pit to crushing plant.*

# CASE HISTORY

## *Dart Trucks with Fluid Drive at Mahnomen Mine*

*By* *F. A. KELLEY

AS THE facts and undoubtedly the greater part of the analysis contained in this article are direct complements of, or indirectly associated with the development of the trucks used at the Mahnomen Mine during the past season, it is fitting that reference be made to the fact that they were conceived by the late W. H. Gallagher, mechanical engineer in the Lake Superior District. Mr. Gallagher contributed much directly and indirectly to the mechanical designs of the tools now considered standard in the mining industry of the Lake Superior region and the trucks referred to were probably his outstanding achievement.

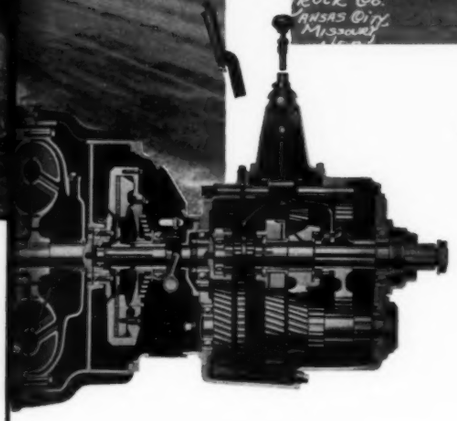
As it became apparent that radical changes in the form of transportation for iron ore from open pits were inevitable, Mr. Gallagher and his staff made an exhaustive study of the various properties which might be affected, analyzing them on: straight truck haul to loading bin or beneficiation plant; truck to transfer pocket, and rail haulage to loading bin or beneficiation plant; tractor and wagon haul to conveyor belt loading to plant; and electric haulage, using individually powered load carrying units. It was finally decided that the most economical haulage for the Mahnomen was the straight truck haulage to final delivery location.

Notwithstanding that all of the above mentioned systems have their particular advantages, hauling the ore from the shovel to final point of delivery seemed to fit our particular problem at the Mahnomen Mine.

When it was decided to use straight truck haulage, it was apparent that given a unit capacity, if a truck could be designed for a greater speed than those in use at that time, it would require fewer units to haul the required product with the accompanying advantages from a cost standpoint. After a full study it was finally decided to have the Dart Truck Company of Kansas City, Missouri, build the units.

Mr. Gallagher had worked out a combination which he believed to work satisfactorily, and a few of the original specifications were brought out in his article published in the November issue of the "Mining Congress Journal" which he wrote before his death. Quoting from this article, they were as follows: "four wheeled truck with a 13.50" x 24" dual tire on the rear and 12.00" x 24" in the front. The gross load capacity to be 62,000 pounds and the pay load capacity 36,000 pounds. A 9 cu. yd. water level capacity body to be carried over the rear axles with a rear dump, scoop ended, to be raised and lowered by a horizontal, double acting hydraulic cylinder through rocker arms. The engine to be oil burning, 1,600 rpm. and to de-

*General Superintendent, Mining Department, Pickands Mather & Co., Ironton, Minnesota.

*The first order placed by Pickands Mather & Co. called for six and the second order for seventeen Dart trucks like that shown, all powered with Waukesha-Hesselman engines.*

*Cutaway view of the Hydraulic Coupling fluid drive, Lipe clutch, and Fuller transmission.*

*Truck loading under a four yard 120-B electric shovel.*

liver 185 hp. to the transmission. The transmission to have eight forward speeds ranging from 3.3 to 31.4 mph. The clutch to be single plate, and interposed between the engine and the clutch a fluid coupling introduced to reduce shocks and give infinite rates of acceleration. Air brakes, electric starters, and all other auxiliaries to be included. The cab to be offset 14 in. to the left to give better vision while backing." It was estimated that this combination would allow a loaded truck a speed of eight miles an hour traveling up an 8 per cent grade.

After it was definitely decided to build a truck on the above specifications, representatives from the respective manufacturers of the component parts to be used in the assembly; namely, the Waukesha Motors, American Blower Corporation (Hydraulic Coupling Division), W. C. Lipe clutch, Fuller transmission, Timken-Detroit differentials and axles, Woods hoist and the Dart Truck Company, held a conference, at which time the specifications proposed were discussed. Each representative took his respective problem home and after thorough investigation, decided that such a truck could be built and the estimated performance attained. At a final conference, all questionable points were ironed out and the manufacture of the truck was started as soon as possible.

The final product followed the specifications very closely but there were a few inconsequential changes which altered slightly the specifications originally set up. It was found that the final weight of the light truck was more than originally anticipated which cut down the pay load to 34,000 pounds. The design was changed slightly in the body which increased the cu. yd. water level capacity from 9 to 9½ cu. yds. The actual performance of this unit in the field proved more satisfactory than anticipated, especially as to speed under load on an 8 per cent grade. Instead of eight miles an hour, a speed of somewhat in excess of ten miles an hour was attained.

The trucks were first used in cutting 1,800 ft. of road on an 8 per cent grade down the side of the rock wall located on the north side of the No. 1 pit. The yardage moved from this operation was used to make a sub-grade of 1,400 ft. from the ledge at the west end of the pit to the crushing plant and also to make yard room behind the loading bin at the crushing plant for storage of empty ore cars.

During this preliminary road building operation, it became definitely apparent that the primary requisite of an economical truck haulage is a good road, and especially that part of the haulage which is permanently located. This operation required starting the trucks on an 8 per cent grade loaded with 10 cu. yds. of loose rock and first an attempt was made to operate the trucks along the conventional lines; namely, starting in low gear and shifting up to the maximum haulage speed. It was during this

*View showing loaded truck at the crushing plant.*

time that most of our breakages and mechanical trouble developed as it was not possible to get enough momentum to keep the trucks moving during the time required for shifting gears. A number of broken axle shafts resulted, also considerable mechanical clutch trouble. This probably is excusable as the manufacturers themselves had no definite idea as to how a truck with a fluid flywheel should be driven. As more experience was gained, it was finally decided to spot the trucks crosswise with the 40 foot wide sub-grade and start in the regular haulage gear. This allowed the motor to get up sufficient speed before the turn straight up the grade was required, which eliminated excessive slippage in the fluid flywheel. This practice of starting in the regular haulage gear worked so well that it has been established as a standard method of driving the trucks. The action of the fluid flywheel under normal torque requirements permits the engine to accelerate in gear from idling speed to maximum engine speed, and to transmit the resultant increase in power to the drive shaft without shock. The slippage up to about 800 rpm. is 100 per cent. From then on it decreases with increased engine speed until at maximum engine speed it is reduced to approximately 2 per cent. The maximum 100 per cent slippage may be taken for about three minutes without damage to the mechanism. To summarize the statistical data accumulated during the past season relative to operation of these trucks at Mahnomen Mine each of the following subjects will be treated briefly: capacity of trucks, cycle of operation, cost per truck hour, and cost per ton mile.

As stated above, the trucks are designed to carry a pay load of 34,000 pounds. The individual daily records showed considerable variation which was due to two major conditions. 1. The manganiferous iron ore is much lighter than the straight iron ores of the Mesaba Range. Figures which have been developed over a period of years, would indicate this to run 15 cu. ft. or better to the ton. 2. Loading conditions and the type of shovel loading, had material effect on the average weights from day to day. Loading below the truck, the 120-B electric shovel with a 4-yard dipper capacity can fill the 9½ cu. yd. body with a heaping load with two full dippers, but loading on the level, if it is attempted to load with a full dipper, excessive spill occurs and if dippers are partly loaded, two swings of the shovel distributes the ore in the truck body in a manner that makes it impractical to attempt to add another part dipper. On the other hand with a shovel with a smaller capacity requiring more swings, a better rounded average load will result when loading under adverse loading conditions. A large proportion of the ore loaded during the past season was produced from track approach benches and other ore which was inaccessible for mining with rail equipment, as it is obvious that it was necessary to bring these ores at higher elevations down to the bottom of the pit before sinking further. Loading conditions in such banks were not normal and were adverse in most instances. Often the shovel was above the loading elevation and a very small proportion of the time was the loading done from a normal position; namely, below the loading elevation. This had a tendency to lighten the loads for that portion of the tonnage that was loaded under such conditions. The average loads computed from actual weights of the ore shipped was 12.90 long tons. From a cost standpoint, experience thus far would indicate that the tons per load is not so important, within reasonable limits, as long as the loading unit is kept busy, or as in the case at times at the Mahnomen, where the neck of the bottle becomes the crushing plant, when sticky ore is being mined.

Theoretically, a certain number of trucks can be figured to carry a certain tonnage, but practically it has been the experience at the Mahnomen, at least, that it is advisable to have extra capacity available if possible. Of course, there may be times when, say, four trucks would keep the shovel busy. It is obvious that under these circumstances the loads should be of maximum capacity, but if it requires 4½ trucks to attain the theoretical capacity, five trucks will be required in the fleet, and under that condition it is just as economical to run lighter loads and keep the trucks moving, as to load them to maximum capacity and take some idle time at the shovel while waiting for loads. In such instances, when a truck is loaded a ton or a ton and one-half light, it has no actual effect on the efficiency, and probably is an indirect help to the costs in the end from the standpoint of truck repairs. In other words, it boils down to maximum number of trips rather than machine capacity per trip.

Many stop-watch studies were made relative to the different factors in the complete cycle of the haul. The maximum round trip distance at the Mahnomen last season, for ore, was approximately 9,400 ft. and the maximum lift 265 ft. The cycle from that point, loading with a 4-yard shovel, averaged around ten minutes, sometimes slightly less, and sometimes a few seconds more, but it is believed that ten is a good average. Loading time in this cycle was fifty seconds and the dumping time fifty seconds. The average distance of haul for the season was: loaded .73 miles – empty .70 miles – total distance 1.43 miles. The average cycle for the year, including delays, was 12.64 minutes. There were 304,168 tons of all material hauled by trucks during the season and this tonnage was elevated an average of 206 ft. The maximum round trip distance for lean ore was 10,000 ft. and the maximum lift, 325 ft.

The cost per truck hour, exclusive of depreciation, was $2.35. This, however, is not representative as no tire cost has been experienced to date. Estimating a 3,000 hour life for tires, the cost would be $.488 per truck hour for tires which would give a total cost per truck hour of $2.838. As a yardstick for comparing one truck operation with another, it is not believed that the truck hour cost is as satisfactory as a ton mile cost. It is obvious that it costs more to elevate than to transport on a level grade, and therefore, the feet of elevation involved in a cycle becomes a variable. The fuel cost per truck hour for the oil burning trucks on the basis of tank car lots, averaged $.4918.

The ton mile cost was $.0513. This figure does not contain an allowance for tire cost which, if charged on the basis of 3,000 hours, would amount to $.0131 per ton mile, or a total cost of $.0644 per ton mile. The fuel cost per ton mile averaged $.0119 for oil burning trucks on the basis of tank car lots.

*The Diesel driven dragline loads the "doodle-bug" which "pans" out the gold.*

# DIESELIZED PLACER GOLD MINING

*By* WILL H. FULLERTON

THE modern placer mine is a far cry from the pan rocking old timers who dreamed of nugget loaded streams. Today, many of the profitable placer mines are those which wouldn't pay a man to work by hand, in fact, many were thought to have been worked out. Most of the surface gold has been taken in the U. S., but untold amounts of free gold still lie beneath the surface.

It is said that about 85 per cent of the gold in existence today is free gold. Quartz mining produces the other 15 per cent but quartz mining also costs about 40 per cent of the total mining expenses of both fields. Placer mining is much the cheaper method of extracting the mineral and also offers a better chance of success. Net profit from these gold "gleaning" operations is closely tied up with peak efficiency from the machinery used and low-cost power. It is for these reasons that many have come to rely on the dependability and economy of Diesel engines.

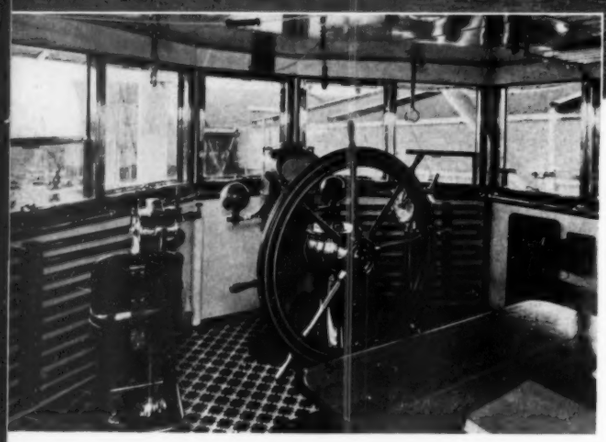
At the city of Stockton's Reservoir, about six miles north of Valley Springs in California, Lord & Bishop are working an interesting placer gold mining plant. It combines a huge Dieselized multiple flume gold panning machine called a "boat" or a "doodle-bug" and a new Diesel-driven 3-yard dragline to feed the gold bearing material to it.

On the day shift six men run the entire plant. These include the dredge-master or foreman, the winchman or operator of the "boat," an oiler for the "boat," a man to run the dragline, a ground crew consisting of a welder or blacksmith and a bulldozer operator who prepares the surface of the ground to be worked. On the night shifts, only a shovel man, winchman, and oiler are at work. The entire operation represents an investment of about $90,000.

Lord & Bishop recently purchased a new Marion 3-yard Dragline powered with a 200 hp. Model L, 6-cylinder Cummins Diesel engine to furnish the boat with material. Moving 200 yards of material per hour the Diesel uses only four to five gallons of Diesel fuel per hour. The dragline works three 8-hour shifts per day and feeds the "doodle-bug" 14 to 15 hundred yards of material per shift.

The unit, which has been working here since early March, 1939, digs into the face of the pond down to bed rock which may be from a foot to sixteen feet below the surface of the earth. Usually the gold lays within 18 in. of bed rock. Unusually fast for such a unit, the Diesel dragline lifts two to three 3-yard loads per minute with an easy, continuous lift and swing. The unit is subjected to constant shock loads when digging in close to the edge of the pond because the mud creates an amazingly strong suction on the bottom of the bucket. As the dragline digs out the face of the pond, the material passes through the "doodle-bug" and is expelled at the back end. The "tailings" thus constantly fill the back of the pond, as fast as the dragline digs away the face, and the whole unit makes a steady forward march.

Such is the operation of a modern placer gold mining machine. Others are in use which employ a bucket line on the front end of the boat in place of a separate loading unit, the Diesel-powered dragline in this case. Most feel that the separate loading unit is more efficient, however. It would certainly be interesting to find out what an old "forty-niner" would think of gold-mining in 1939 style.



*The lighthouse tender "Narcissus" which is powered with two Superior 200 hp. Diesels. View of the wheelhouse at the left.*

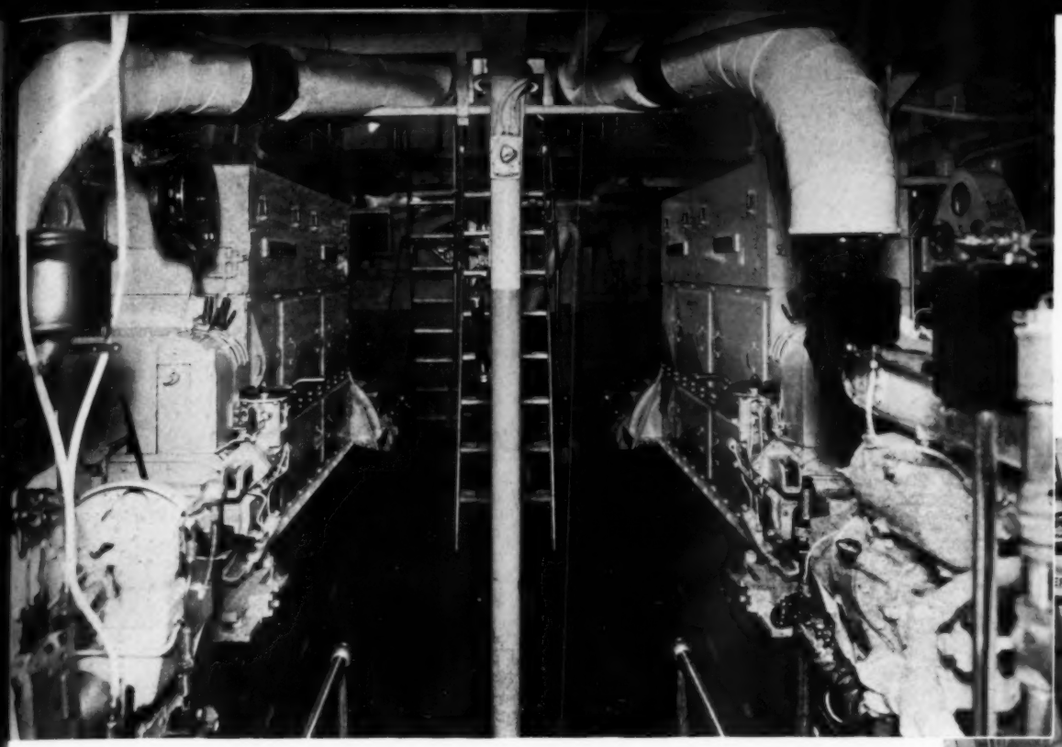
# NARCISSUS, ZINNIA AND MAPLE

***Three New Geared-Diesel Coast Guard Tenders Complete First Six Months' Service***

WASHINGTON, D. C.—"The maintenance of lighthouses, lightships, radiobeacons, buoys, and other aids to marine navigation is now a function of the United States Coast Guard, the Lighthouse Service having been consolidated with that organization on July 1, 1939."

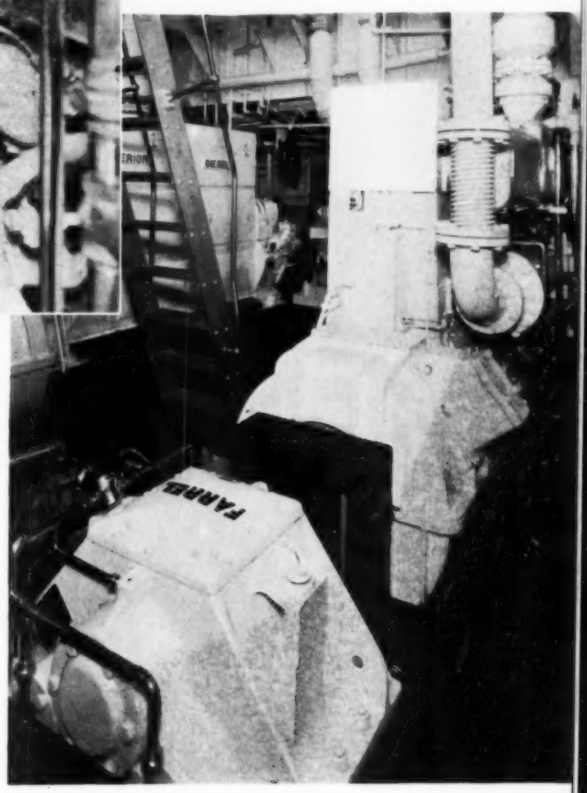
The above action terminated as a separate entity one of the oldest Federal agencies, the United States Lighthouse Service having been established at the first session of Congress in 1789. In fact, early documents pertaining to this vital work carry the signatures of such notables as Alexander Hamilton, George Washington, and John Adams. As with many other important functions of our national life, the maintenance of aids to navigation is largely taken too much for granted, mainly because this work has always been performed efficiently regardless of weather conditions and frequently against seemingly insurmountable odds, since, in this work, the need is greatest when the elements are at their worst. Because of the wide geographic distribution of aids to navigation on the sea coasts, Great Lakes and navigable rivers of the United States, with an aggregate coastline of over 40,000 miles, the work of maintaining the navigational aids is participated in by the thirteen Coast Guard districts into which the country is divided.

The general public has for long been familiar with lighthouses, with lightships, and with buoys, fog signals, and other aids. Not so familiar, however, are the tenders whose duty is to distribute food, supplies, and fuel to lighthouses and lightships; to fuel, repair and adjust the ever-increasing number of automatic or unattended lights; to replace buoys at intervals with reconditioned units; plus a multitude of other jobs too numerous to mention. Suffice it to say that there are over 30,000 aids to navigation, a large percentage of which require servicing at regular intervals by this fleet of tenders, and it is the responsibility of the marine design division in Washington to furnish their crews with seaworthy yet economical ships, correct in every respect for the many peculiarities of service and operation. To say that such demands are exacting is an understatement when one considers the thousands of human lives and millions of dollars worth of shipping that depend upon successful completion of these vessels' daily routine. At present the Coast Guard has the following tenders in active lighthouse service: 40 steam drive, 12 Diesel-direct drive, 4 Diesel-electric drive and 6 Diesel-gear drive, or a total of only 64 to perform all of the essential duties as outlined previously. From this it is obvious that dependability and availability rank high on the list of general specifications. Other requirements include (1) unusual stability, for hoisting buoys over side; (2) minimum draft, for approaching shoals and obstructions; (3) cargo capacity for food, fuel and supplies to be delivered; (4) speed, to respond to emergencies; (5) economy of opera-



*View showing operating stations of the two main propulsion Diesels on the "Narcissus."*

*Aft view of the main engines showing one of the Farrel Birmingham reduction gears.*



tion, for the benefit of the taxpayer; and, (6) ice-breaking ability.

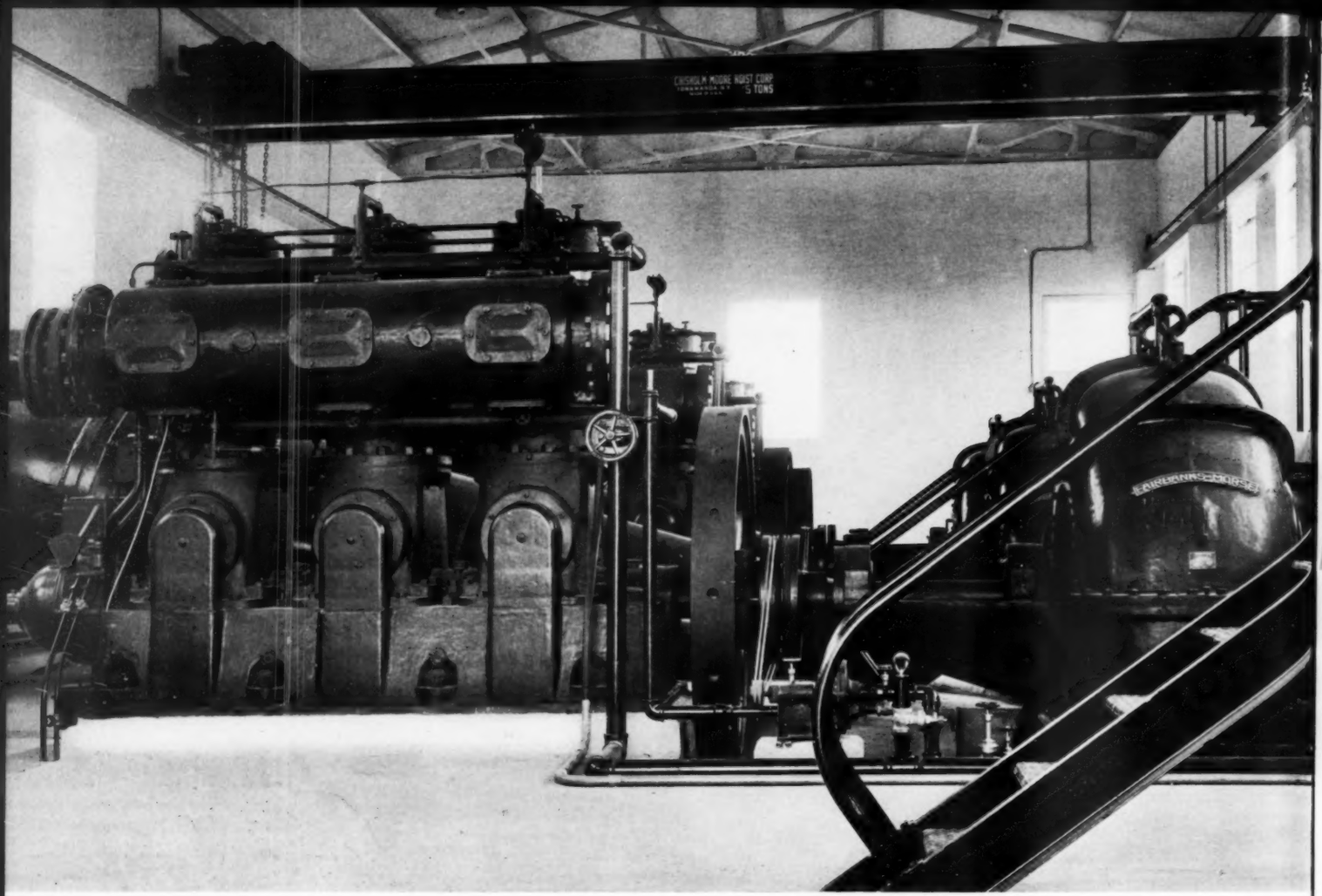
In laying out the three latest tenders of the 120 ft. class, the designing engineers were faced with the problem of reconciling two opposing demands: correct propeller speed for maximum control and maneuverability at slow speeds and maximum power with minimum machinery weight, both of these requirements to be met as economically as possible consistent with satisfactory performance. The proven economy of marine Diesel engines in stop and go, intermittent service gave them preference as main and auxiliary power units and the development of marine reduction gears to their present standards of performance permitted the use of relatively light weight, high-speed engines without sacrificing efficient propeller speed.

The general features of design and construction of these ships are as follows: shell plating is riveted, but all interior framework, bulkheads, longitudinal stiffeners and decks are welded to save weight. Roughly 40 per cent of steel construction is welded to save almost 14 tons, or approximately two and one-half inches of draft. Five transverse, water-tight bulkheads divide each ship into six water-tight compartments, and construction is completely fire-proof throughout. A flat-plate keel saves another five inches of draft and the shell plating is welded instead of flanged to what is virtually an inside stem. To facilitate dry-docking and painting, a one by six inch steel flat bar is welded flatwise below the keel plate to provide hull clearance from the blocks.

Principal dimensions of the *Narcissus, Zinnia* and *Maple* are as follows: l.o.a. 122 feet; beam 27 feet, draft 6½ feet, and displacement 342 tons. The first two were built by the Mathis Shipbuilding Company, Camden, N. J., for the Norfolk and Jacksonville districts, respectively, and the third by the Marine Iron & Shipbuilding Company at Duluth, Minnesota, for the Cleveland district.

Main propulsion is supplied by twin Superior Diesels rated at 200 hp. each at 600 rpm., which drive Ferguson propellers through Farrel-Birmingham reduction gears, giving "wheel" speeds of 280 rpm. at full engine speed. Obviously, the twin screw design also saves materially in the ships' draft. Two Superior Diesels also drive the generator sets of 7½ and 10 kw., respectively. Auxiliary equipment is electrically operated throughout and Exide batteries float on the generator lines. Propeller thrust is taken by a Kingsbury thrust bearing on each shaft, installed aft of the Farrel gear. Main engines operate on closed cooling systems with Ross heat exchangers installed for this purpose. Both engines are equipped with Alnor pyrometers and Reliance tachometers, also. Both fuel and lubricating oil are centrifuged on the batch system through a Goulds Hydroil purifier. A Wright ½-ton hoist serves for pulling pistons and other routine maintenance.

As in private design and construction, much is learned from actual service operation, and these three latest additions to the lighthouse tender fleet represent the last word in this unique and exacting service. The limited personnel in charge of design, and specifications in Washington, on whose shoulders such heavy responsibility rests, are to be congratulated upon the eminently successful shake-down work of the ships to date. Field reports are unanimous in honest satisfaction with their performance, and they are written by men not given to idle praise. The application of reduction gear drive to this type of service indicates an alert appreciation by the design staff of new possibilities in marine propulsion to maintain and further the high degree of efficiency in this department, which stands unequalled throughout the world. Both the United States Coast Guard and the former Lighthouse Service have earned the admiration and respect of international mariners in years past. As a consolidated unit they guarantee coast and navigable waterway protection for this country second to none.




*View of the relift station, which is located fourteen miles west of Raymondville, Texas. This plant distributes water from the reservoirs to the irrigation ditches.*

# WILLACY COUNTY IRRIGATION

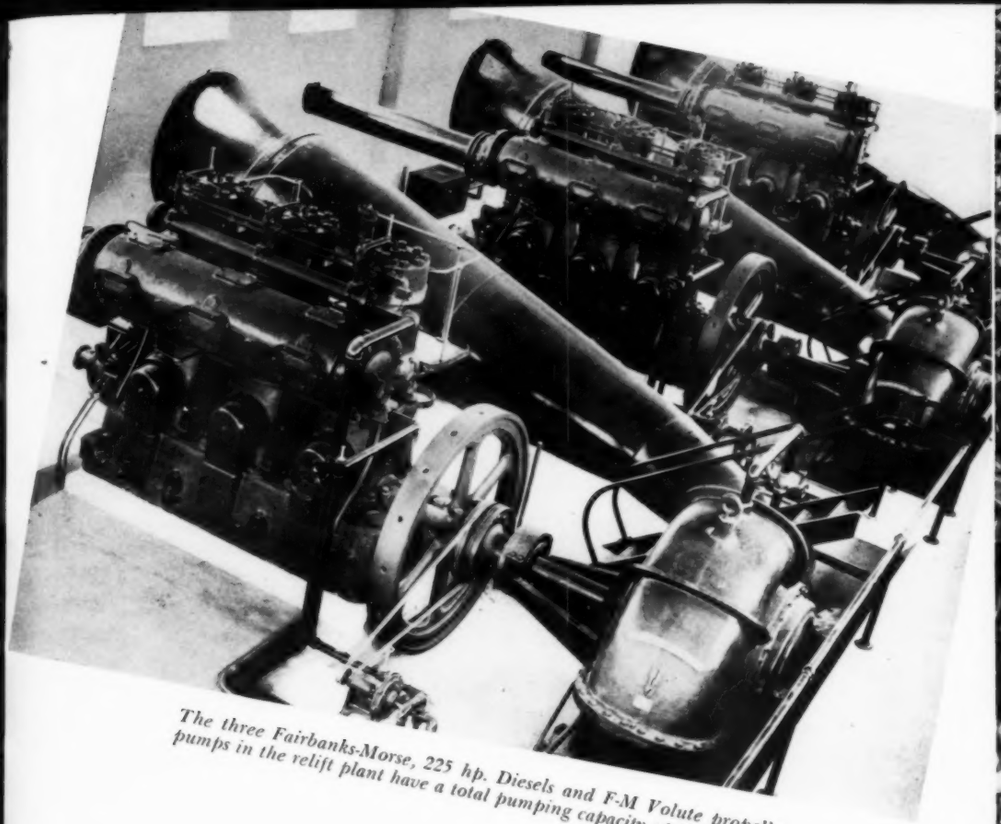
*By* A. V. REITER

NINETEEN hundred and fifty Diesel horsepower made up of seven engines in two different plants bring to life 120,000 acres of semi-arid land on the outskirts of Texas' Lower Rio Grande Valley. As the Willacy County Water Control and Improvement District No. One nears the full fruition of its project which began operations in 1938, the narrow strip of Texas' tropical valley growth extends northward under irrigation supplied by Diesel driven pumps capable of handling 380,000 gallons of water per minute.

To transform this barren area into a fertile land where citrus groves, truck gardening, and cotton raising could flourish during the year-round growing season presented many difficulties to be overcome. The first problem was water. Without an adequate and reliable supply, which the normal rainfall could not produce, the soil was practically unproductive.

Raymondville, the seat of Willacy County from which negotiations were managed, is situated thirty-three miles north of the Rio Grande River, its only large source of water supply. Although the eastern extremity of Willacy County borders on the Gulf of Mexico, its salt waters, of course, cannot be used for irrigation purposes. To bring water from the Rio Grande River, the only available source, would then entail great expense. Realizing the great benefits to be derived from making this section productive, the Federal Government lent aid to the project with an allotment in excess of $5,000,000. The only obstacle remaining was to install engines of which the low cost of operation would make the pumping of water feasible. Diesel engines were chosen to meet this requirement.

All water is pumped from the river station at Rio Rica in Cameron County at an average 10 foot static head. From here it flows by gravity through one main canal which extends 32 miles due north and empties into two huge reservoirs that cover approximately 3,000 acres. It is estimated that this furnishes a storage



*The three Fairbanks-Morse, 225 hp. Diesels and F-M Volute propeller pumps in the relift plant have a total pumping capacity of 108,000 gpm.*

*A typical citrus grove in the Willacy County district.*

capacity of 30,000 acre feet of water. The reservoirs are constructed by levees raised twelve feet high and sixty feet wide across the top, and serve as storage basins permitting water to be taken from the river when it is above normal in its flow. The eastern and southern portions of land slope toward the Gulf of Mexico, thus allowing irrigation by a system of gravity fed canals.

To the west the land rises and breaks into gentle rolls. From the reservoirs, then, the water is lifted 14 to 16 feet to the higher elevation by a Diesel driven pumping station and sent through a highline canal which flows approximately 15 miles to the land it is to irrigate. The relift station is built at the west end of the reservoirs. Altogether the main and subsidiary canals and cement pipe lines form a network of 340 miles.

In 1938, the two pumping plants installed seven Fairbanks-Morse Diesel engines; four engines of 300 hp. each in the river station, and three 225 hp. engines in the relift station. These engines are Fairbanks-Morse's latest development with needle piston pin bearings and back flow automatic scavenging cylinders. The engines show trim lines which are enhanced by using water cooled exhaust manifolds.

The river plant is one of the largest pumping plants on the Rio Grande. The four 300 hp. engines are Fairbanks-Morse Model 32E14 units 300 rpm., 4 cylinders 14 in. bore 17 in. stroke, each direct connected through flexible couplings to a Fairbanks-Morse 48 in. volute propeller type pump. Each pump is designed for 68,000 gpm. capacity under normal operation. Each suction line is 6 ft. in diameter and was fabricated along with the discharge piping by Wyatt Boiler & Metal Works.

The relift plant consists of three 225 hp. Fairbanks-Morse Model 32E14 Diesel engines, 300 rpm., three cylinders 14 in. bore, 17 in. stroke, each direct connected through flexible couplings to a Fairbanks-Morse 42 in. volute propeller type pump. Each pump is designed for 36,000 gpm. under average pumping conditions.

In both plants the following are used throughout: Crane Company piping and valves, 5-ton Chisholm-Moore hoists, Fisher air trap valves, Alnor pyrometers, Fairbanks-Morse Co. gauges and thermometers, Gardner Denver air compressors, Purolater lubricating oil filters, Nugent fuel oil filters, American OCH air filters, Allen Bradley motor starters, and GH45 Youngstown Miller oil purifiers. Each engine is equipped with a Madison-Kipp lubricator. The air tanks are supplied by Diesel Plant Specialty Co. Nash vacuum pumps are installed in each station for use when it is necessary to prime the large volute propeller type pumps. An audible alarm system operates by means of a Detroit lubricator switch in case of excessive jacket water temperature or low lubricating oil supply.

The entire irrigation system is well engineered. To Mr. W. E. Anderson of San Benito, Texas, goes much of the credit for development of the $5,000,000 project under his supervision. The high efficiency and low operating cost of the Diesel engines carry through the expectations and make it possible to realize the productive potentialities of what might have remained a semi-arid land. Now the land under irrigation may produce, without the water-shortage element of chance, varied and year-round crops such as citrus fruits, cotton, strawberries, and vegetables. The value of the project is also increased in that its greater fertility supports an ever-increasing population.


*This view shows the last two Diesels installed at Blackstone. In the foreground the F-M 6 cylinder Diesel installed in 1934; in the background the Chicago Pneumatic 8 cylinder Diesel installed in 1937.*

*General view of the Blackstone plant with Mr. A. Lee Bland, Engineer, standing at right corner of the building. The Marley cooling tower is at the extreme right.* →

# BLACKSTONE VIRGINIA

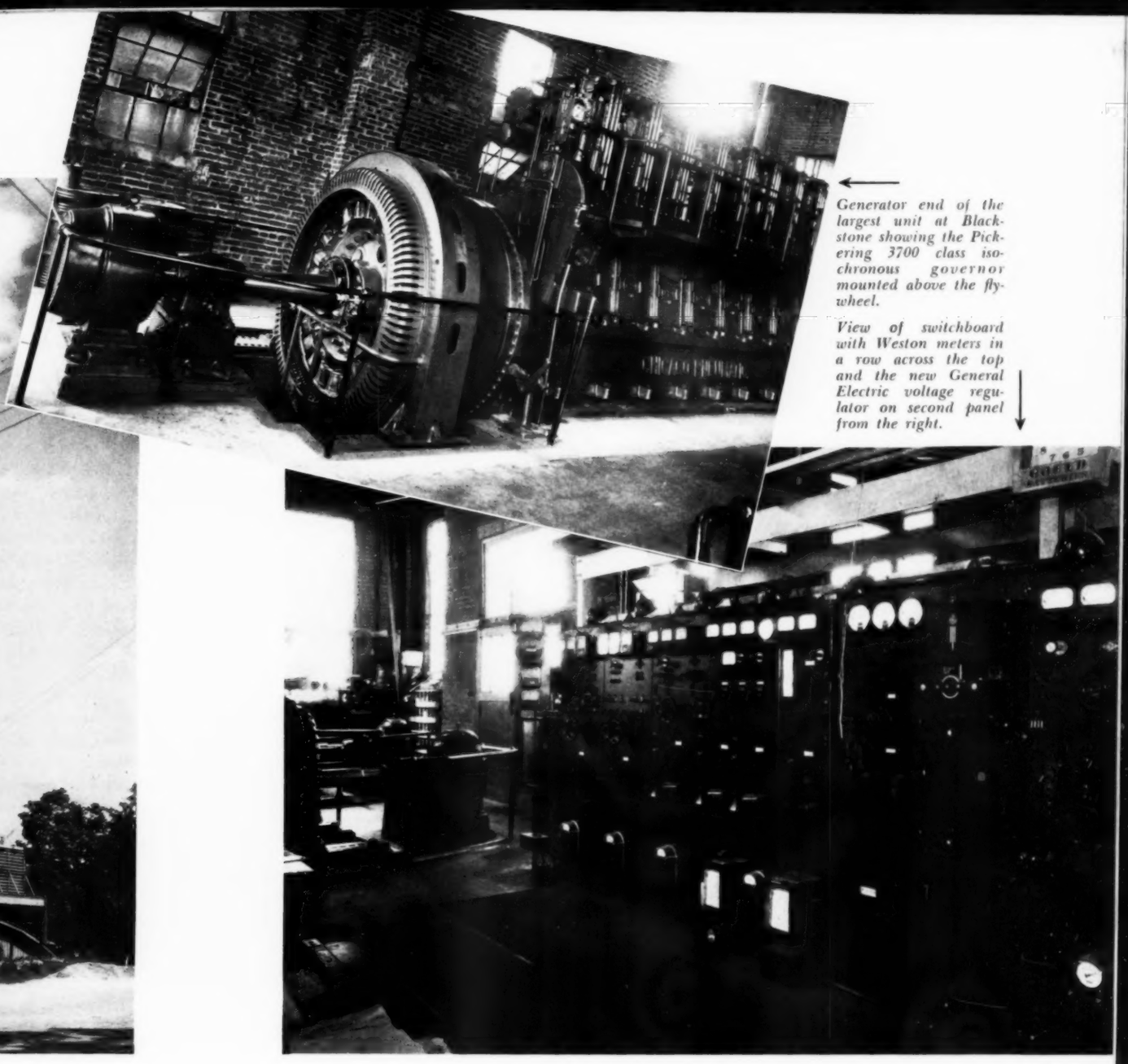
WITH the installation of a Chicago Pneumatic 8-cylinder, 800 hp. Diesel in 1938, the Blackstone Municipal Light Plant rounded out a full decade of successful operation. Out of operating revenue, the plant paid for the first two small Diesel generating units, also two larger units added midway in the decade, beside assisting the community with civic improvements including a new municipal building, an armory, new street lighting, new curbs and gutters, hard surfaced streets and water works extension. The history is that of persistent effort on the part of a few individuals against not only local resistance but the active opposition of a utility operating under franchise.

The advent of a municipally owned light plant at Blackstone, Va., in 1927 involved all of the normal political procedure plus the obstacle presented by a utility franchise extending some ten years into the future. The few far-sighted citizens who visioned the plant and its advantages were rewarded within the first year of operation. In this short period the plant reached a paying basis and had signed up all but a handful of the local customers.

Under the engineering guidance of Mr. A. Lee Bland, the plant opened on June 16, 1927 with two Fairbanks-Morse Diesels, a 3-cylinder, 180 hp., and a 4-cylinder, 240 hp., both 2-cycle crankcase scavenging, direct-connected to Fairbanks-Morse generators of 120 and 160 kw. ratings respectively. In August, 1929, a Fairbanks-Morse 6-cylinder, 360 hp. Diesel and 240 kw. generator went on the line and in 1934 another F-M 6-cylinder, 300 hp. Diesel and 200 kw. generator were added.

Output in 1928, the first full year's operation, was 428,000 kwh. and for 1933 the plant produced 3,416,400 kwh. This impressive load growth was associated with the expansion of Blackstone's major industry, a large silk mill which closed at the end of 1933. Since then the mill has resumed partial operation and the annual output for the last five years has averaged about two and one-half million kwh. Cost per kwh. averages 6½ mills.

During 1937, negotiations were started for a



*Generator end of the largest unit at Blackstone showing the Pickering 3700 class isochronous governor mounted above the flywheel.*

*View of switchboard with Weston meters in a row across the top and the new General Electric voltage regulator on second panel from the right.*

single generating unit large enough to carry the basic load, with the idea of keeping the smaller units available for the fluctuating industrial load. This culminated in 1937 with the installation of a Chicago Pneumatic 8-cylinder, 800 hp., 14 in. bore, 22 in. stroke Diesel and Electric Machinery Corp. 700 kw. generator. Plans are now under way to equip this engine with a supercharger, and the necessary valve mechanism changes, which will increase its power rating 20 per cent.

The Chicago Pneumatic Diesel engine installed in the Blackstone plant is equipped with a Pickering 3700 Class isochronous governor which has proven highly successful in operation. The essential working parts of the engine are American Hammered piston rings, Satco main bearings and a Titusville crankshaft. A Quincy air compressor driven by a General Electric motor supplies starting air. The engine is fitted with a Burgess intake air filter, a Maxim exhaust silencer, Alnor exhaust pyrometer, Manzel force feed lubricator, American Bosch unit fuel injection pumps, Motoco jacket water thermometers, and Nugent fuel oil filter. The Texas Ursa lube oil is treated once a week in a Goulds Hydroil. The oil is first pumped from the engine sump to the dirty oil collection tank and is then centrifuged with the addition of heat and water which removes the heavy gums and carbon. The oil is then recentrifuged at high temperature to "dry" it and the result is clear, clean full bodied lube oil.

A Marley tower was added to the cooling system when the last engine was installed. The switchboard carries two General Electric voltage regulators and a Weston synchroscope. All meters are Weston.

This entire operation, its history and continued success is closely associated with the personality of Mr. A. Lee Bland. Beside serving as power plant and water works engineer and doing special police duty on all extraordinary occasions, Mr. Bland finds time to maintain the plant records. His plant has become the mecca of community engineers from three neighboring states, who would learn how best to launch their own plant programs and who are favorably impressed with Diesel motive power.

# DIESEL FARM TRACTORS IN KANSAS

*By* E. L. BARGER*

VERY little data are available on the "everyday" life of the Diesel on the farm. The average farmer does not keep complete records and, if he does have records, it is only rarely that they are made available to the reading public. What has been the experience of the farmer who has used Diesel engines? This and many other questions were answered by a survey of Kansas farm Diesel tractors made to obtain some information on the use of Diesel tractors on farms by the Department of Agricultural Engineering at Kansas State College in the Spring and summer of 1939.

On March 1, 1939, according to the sales records of the Diesel tractor manufacturing companies, there were 297 Diesel tractors on Kansas farms. Satisfactory reports were obtained from 119 or 40 per cent of the farm Diesel owners. The accompanying map shows the distribution of the tractors in Kansas.

The Kansas farms on which Diesels are used averaged 926 cultivated acres per farm. Fifty-five and nine-tenths per cent of these had one or more tractors of conventional Otto cycle type on the farm in addition to the Diesel. Those farms which used Diesel engines only, or the remaining 44.1 per cent, averaged 680 acres per farm. That the Diesels are on the larger farms is evidenced by the fact that the average size of all farms in the state is 275 acres. The farms covered by the survey ranged in size from 122 to 5,000 acres.

In answer to the request for the present age of their Diesel tractors, 119 farmers reported an average age of 1.73 years. Ninety-six per cent were purchased new and 4.0 per cent were purchased second-hand.

To arrive at an estimated service life, the owners were asked to estimate the probable future years' service they expected from their machines. The answer was 10.10 years, which would make a total service life expectancy of 11.83 years. At another place in the survey form the total estimated life of a Diesel tractor used under their particular conditions was requested and to this question 101 owners reported an average of 11.13 years. The Kansas farm Diesels were found to have an average rating of 27 hp. on the drawbar and 36 hp. on the belt.

Are you satisfied with your Diesel tractor? On this question, of the 114 owners answering, 97.3 per cent were "yes" and 2.7 per cent were "no." If buying another tractor, out of 111 replies, 96.4 per cent indicated it would be another Diesel, while 3.6 per cent said it would not.

One hundred and sixteen farm Diesel owners answered the question as to whether their experience had shown the Diesel to be a sound farm power unit. The reply was "yes," 98.3 per cent, and "no," 1.7 per cent.

The following are the farmers' opinions on advantages of Diesel power on the farm: Economy, 108; more power, 16; steadier power, 6; dependability, 5; longer life, 4; easier to handle, 4; lesser fire hazard, 2; simplicity, 2; no advantages, 2.

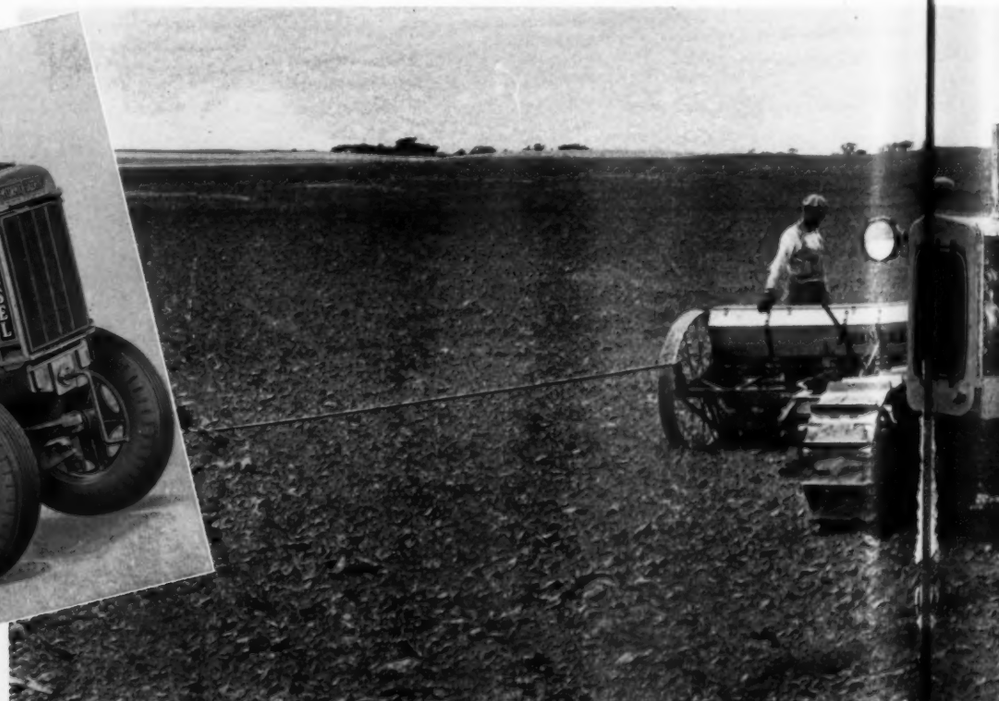
Concerning the fuel problem, some rather significant figures were obtained. One hundred and two operators reported an average yearly Diesel fuel consumption of 1,639 gallons. Out of 119 reporting, 5.0 per cent said they had had difficulty in obtaining good fuel, while 95.0 per cent reported no difficulty. The prices paid for Diesel fuel varied from 4.0 cents to 8.8 cents per gallon. The average of 119 reports was 6.96 cents per gallon. The average quantity of fuel purchased at a time was 481 gallons.

Since many of the Diesel owners have had considerable experience farming with other types of power, it was thought that some opinion could be gained concerning the comparison between Diesel and conventional engines as regards amount and cost of fuel. Seventy-two operators reported an average saving in volume of fuel consumed yearly of 53.1 per cent. Twenty-nine Diesel owners reported a fuel cost saving of 56.7 per cent.

The use of special Diesel engine lubricating oil seems to be the usual practice of farm Diesel operators. One hundred and nineteen gave information on the type of lubricating oil used, and 89.9 per cent of these were using special

*Associate Professor of Agricultural Engineering, Kansas State College.

*Both wheel type and track type tractors are used for farm work. Below: The wheel type tractor with lugged pneumatic tires in common use today. Right: Track type tractor pulling three 13 ft. grain drills, planting at the rate of 150 acres per ten-hour day. Upper right: Map showing distribution of farm tractors in Kansas. Each circle represents one Diesel tractor.*

Diesel lubricating oil, while 10.1 per cent were using common automotive engine oil. An average price of 61.9 cents per gallon for Diesel lubricating oil was reported by 116 operators. The yearly oil consumption was 70.9 gallons per tractor. The average time between drains was 69.1 hours.

The weight of oil being used in farm Diesel tractors was as follows:

| *Weight of oil used* | *Winter* | *Summer* |
|---|---|---|
| S.A.E. 10 | 10.5% | 0.0% |
| S.A.E. 20 | 85.7" | 45.8" |
| S.A.E. 30 | 3.8" | 51.7" |
| S.A.E. 40 | 0.0" | 2.5" |

In answer to the question "Do Diesel tractors require more skilled operators than conventional tractors?" 23.7 per cent of the 118 reporting said yes, while 76.3 per cent said no. As to whether Diesel tractor operators should have some special training on Diesel engines, 114 owners indicated their opinions as 27.2 per cent "yes" and 72.8 per cent "no." Out of 114 reporting, 13.2 per cent said their operator had had some special training, while 86.8 per cent had had no training on Diesels.

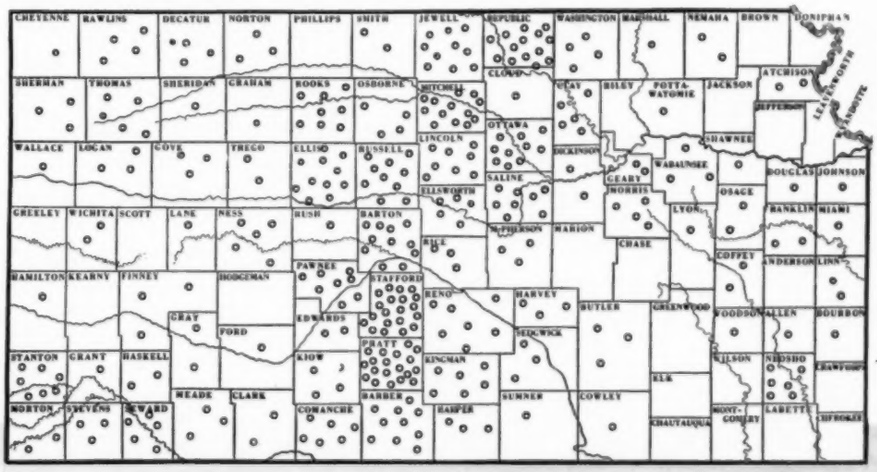
Who operates the tractor? One hundred and seventeen reported as follows: Owner, 10.3 per cent; hired help, 19.7 per cent; member of owner's family, 6.8 per cent; owner and hired help, 28.2 per cent; member of owner's family and hired help, 1.7 per cent; owner and member of owner's family, 12.8 per cent; owner, member of owner's family and hired help, 20.5 per cent.

Since the average age of these tractors was less than two years, the repair and service problem has been minor. Of 96 reporting, only 5.2 per cent had experienced any trouble in obtaining capable assistance on service problems. Ninety-four and eight-tenths per cent reported no trouble in obtaining expert service help. The average age of the 113 tractors on which repair costs were reported was 1.71 years. The average yearly repair expenditure was $18.35 per tractor.

The work done by 117 Diesel farm tractors was predominantly drawbar work. The farm operations performed and the percentage reporting are as follows: Plowing (moldboard), 83.8; plowing (one-way disk plow), 87.2; disking, 81.2; drag harrowing, 74.4; drilling grain, 91.5; listing (blank and planting), 76.9; cultivating, 64.1; harvesting (binder), 37.6; harvesting (combine), 94.8; corn picker, 2.6; corn binder, 31.6; hauling, 32.9; road construction, 38.5; haying, 4.3; custom work (drawbar), 52.2; threshing, 8.5; feed grinding, 14.5; corn shelling, 2.6; silo filling, 9.4; pumping water, 3.4; sawing wood, 7.7; rock crushing, 0.9; custom work (belt), 7.7.

The remarks of the farmers concerning their Diesel tractors were interesting and generously offered. They seemd to be more spontaneous and showed greater enthusiasm than is common in this type of survey. The following quotations are typical of many expressions received from farm Diesel owners. They tell an interesting story by themselves.

"Greatest power plant I have ever owned." "I have just finished listing 120 acres of corn on 40 gallons of seven-cent fuel." "I put 500 hours on my Diesel for $48 worth of fuel. Consider this about one-third the cost of gas." "I used a gas tractor for nine years prior to buying this Diesel and think I am saving $300 per year in cost of operation." "I have both kinds of tractors and can plow twice as much with the Diesel on half the fuel cost." "We own a Diesel and a gas outfit of same size and pull identical 5-bottom plows. We use 75 to 90 gallons per day in the gas outfit and 36 to 40 gallons of Diesel fuel per day in the Diesel." "The secret of good performance with Diesel is clean fuel." "They are not harder to operate; if anything, easier than a gas tractor." "It is a falsehood to say Diesel tractors are more complicated; I find mine simpler."




# TRI-COUNTY ELECTRIC COOPERATIVE

*By* R. D. CAMPBELL *and* DOLPH H. WOLF*

WHEN the history of this decade is written, it will certainly include a chapter on rural electrification. The various rural electrification projects are scattered over the entire country, and the benefits derived from electric power have definitely raised the standard of living in every community where it has been made available. Not all of these projects use Diesel engines, but the great majority use Diesels for a part or all of the prime mover power. The dependability and economy of the Diesel engine has enabled it to play the leading role in many of the projects where other forms of power were not available or were too expensive.

The Tri-County Electric Cooperative of Michigan is a good example of such a project. In 1937 a group of farmers in the Hamlin Township of Eaton County organized an electric cooperative project amounting to some 200 miles of lines. They proposed to purchase power from a small hydro-electric plant operated by the Miller and Sons Dairy. From this modest beginning has grown a system of 1,356 miles of lines, inter-connecting six generating stations and serving over 3,300 rural customers! But that is getting ahead of our story—let us see how it grew.

Miller and Sons operate a modern dairy in the village of Smithville, near Eaton Rapids, Michigan. They had two generating stations for producing their own power, and these could produce some surplus power. The Eaton Rapids station had a 125 kva. hydro-turbine, and the Smithville plant had an 85 kva. and a 165 kva. hydro-turbine. They were supplying current for a few customers when the Tri-County Cooperative was organized. In order to handle the requirements of the Cooperative, two 500 hp. Worthington Diesels were added to the Smithville plant. The details of this installation are described in the December, 1938, issue of DIESEL PROGRESS.

At the time these engines were installed, June 1938, it was intended that the project serve about 1,700 customers along 700 miles of lines. Before the plant was completed, however, there were so many requests for service that the project continued to grow and more power was needed. The system now connects six generating stations, two of which are still under construction. Beside the Miller and Sons plant already mentioned, which is a combination Diesel and hydro-plant, there are the following:

Vestaburg—4 Diesels totalling 2,500 hp.
Burnips—6 International Gas engines of 100 hp. each
Lakeview—100 kw. hydro-electric
Farwell—100 kw. hydro-electric
Portland—the Portland Municipal Plant including hydro and Diesel units.

The Burnips plant is the generating station for the Ottawa-Allegan Project but is connected to the Tri-County Project for the mutual exchange of power. Gas engines are used in this plant because of very favorable gas rates.

The Lakeview and Farwell plants are now being constructed and each is to have a 100 kw. hydro-electric turbine. The care and thought exercised in the engineering of the project are evidenced by use made of the natural resources available. Where there was sufficient water to justify a hydro plant, water power was used; where natural gas was cheaper than fuel oil, gas engines were used; and as there is plenty of good Diesel fuel in Michigan, the Diesel was always an important factor. The project now includes 2,400 kw. produced by Diesel engines, 300 kw. by natural gas engines, and over 500 kw. by water power.

Another important feature of the system is the extreme reliabilty and assurance of service under adverse conditions. This is an extremely important point when it is recalled that winter storms with snow and ice are a routine weather matter in Michigan. Neither winter storms nor an accident in any plant would interrupt service for more than a few customers located out on the end of a line. The heart of the system, the primary distribution, is supplied with power from six widely scattered plants using a variety of prime movers.

The entire project is self-liquidating and non-competitive. It was not financed by grants, but the necessary capital was borrowed from the Reconstruction Finance Corporation. The project does not offer electric service to those now being served by some other system. This means that some 3,300 rural customers are now being served who would not have electric power were it not for the Tri-County Cooperative. Among the customers of the project are many schools, churches, town halls, and grange halls in the North Central part of the state, which had no electric power available until the service was made available by the Cooperatives. Headquarters for the project are at Portland, Michigan.

The rates charged are comparable with rates in small cities and towns, and compare most favorably with rural rates anywhere in the country. There are no minimum charges on any of the rates which are as follows:

DOMESTIC RATE (HOMES, FARMS, ETC.)
First 25 kwh. @ 7½c per kwh.
Next 25 kwh. @ 6c per kwh.
Next 50 kwh. @ 2c per kwh.
All over 100 kwh. @ 1½c per kwh.

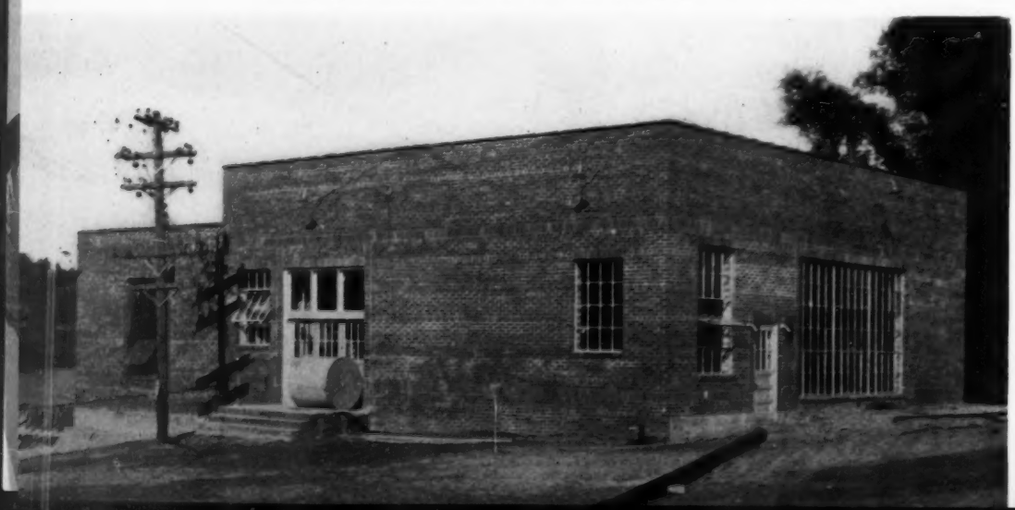
COMMERCIAL RATE (STORES, GAS STATIONS, ETC.)
First 25 kwh. @ 7½c per kwh.
Next 75 kwh. @ 6c per kwh.
Next 900 kwh. @ 3c per kwh.
Next 2,000 kwh. @ 2c per kwh.
All over 3,000 kwh. @ 1½c per kwh.

WATER HEATER RATE (TIMED FOR OFF-PEAK SERVICE) Flat 1.1c per kwh.

There is a rate for large power users, but it is not the primary purpose of the Cooperative to serve this type of customer.

*Manager, The Tri-County Electric Cooperative of Michigan.

*This new power plant at Eaton Rapids, Mich., has two 500 hp. Worthington Diesels and two 345 kw. Elliott alternators installed.*



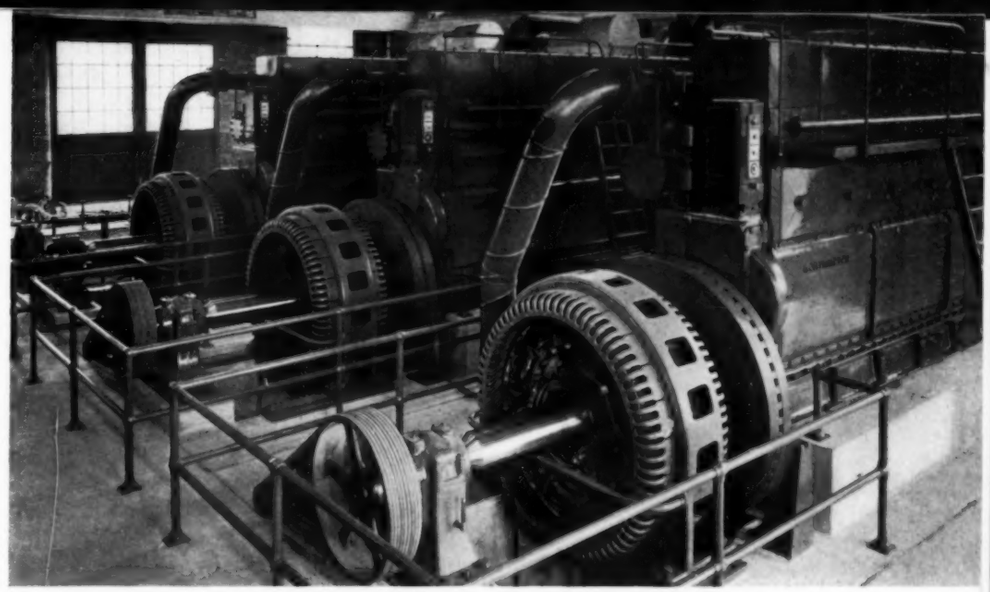
The meters used have a cyclometer-type of recording device instead of the usual dial face. Each customer reads his own meter on the last day of the month, records the reading on a post card form supplied by the Cooperative, and mails it. All billings are made at the Portland office, but there are over 40 authorized pay stations located in stores and other convenient places throughout the area served by the project, at which places the customer may pay his bill. The experience to date shows that over 95 per cent of the customers read the meter and report the reading at the scheduled time.

The services of a special merchandise and utilization manager have been obtained for load building and promotional work. Many appliances are sold through the Cooperative at cost plus freight with no charge being made for the installation. On this basis it is possible to have a well-known make of electric range installed for less than $60. The whole aim of the Cooperative is to furnish rural homes with electric power and its conveniences at the lowest possible cost consistent with good business practices.

Electric power is now being used for lights, radios, refrigeration, pumping water, heating brooders and incubators, grinding feed, and a host of other purposes where in the past some very poor substitute was used. One group of farmers has a community silo filler arranged as a portable unit and powered by a 7½ hp. single phase electric motor. The unit is moved from farm to farm as the conditions require, and power to operate the motor is taken from the line as single phase 220-volt current.

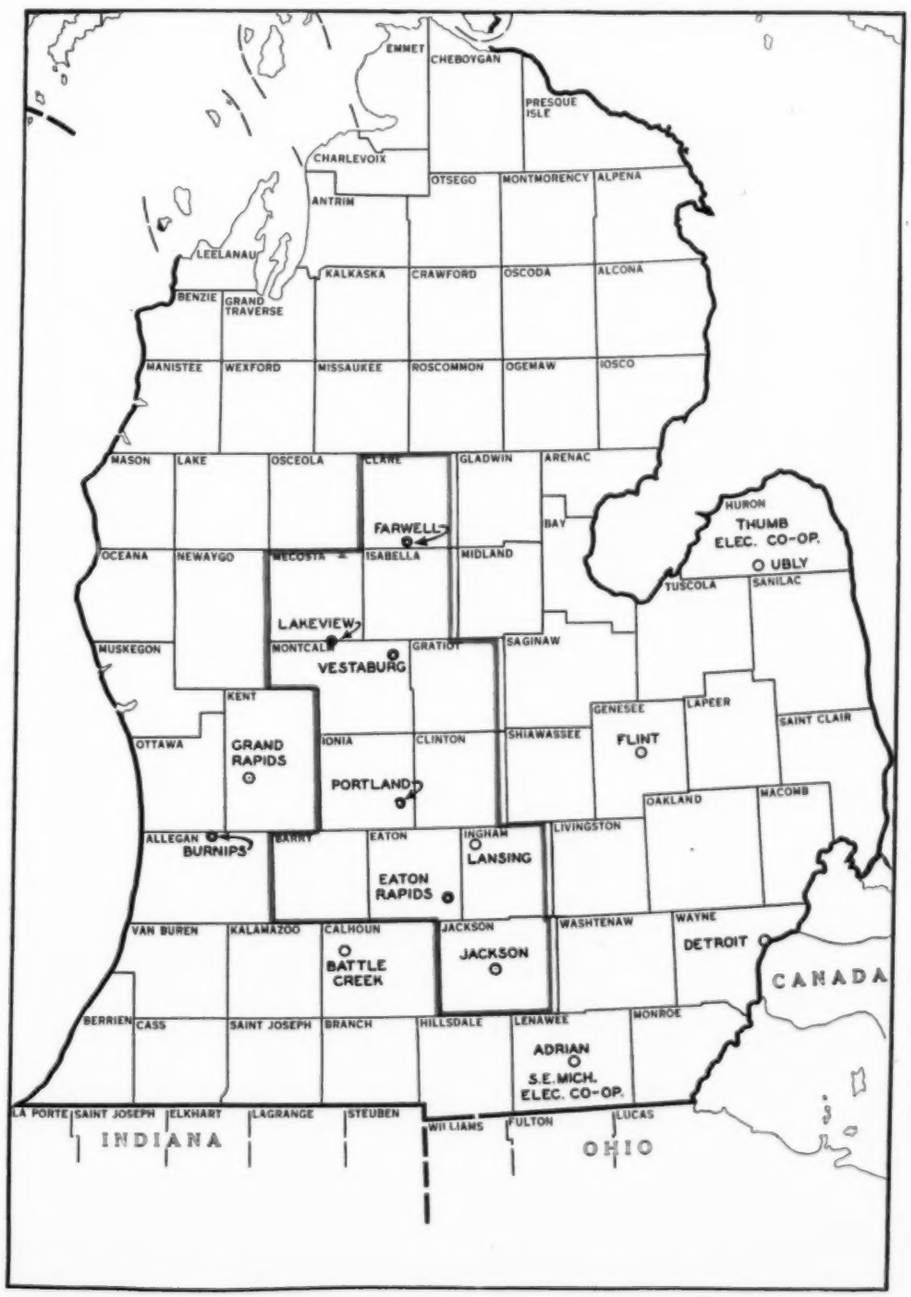
And so, what started out as a small project down in Hamlin Township has grown until it serves over 3,300 customers along 1,356 miles of lines in 82 townships of 13 Central Michigan Counties. Another 100 miles of line are under construction, and customers are being added to the system at the rate of about six each working day.

The Tri-County Electric Cooperative is a fine example of this type of project which is bringing more leisure and less hard labor to American rural homes. The Thumb Cooperative at Ubly, Michigan, and the Southeastern Michigan R.E.A. Project at Adrian, Michigan, are other examples within the same state—and nearly every state can point with pride to an R.E.A. Project within its bounds. It is a service of which the Diesel engine industry may well be proud, for it is the economy and reliability of the Diesel that has made possible the majority of these projects.



*Interior view of the Vestaburg, Mich., plant showing the there 500 hp. Worthington Diesels and three 413 kw. Elliott alternators.*

*This map shows the eleven counties, within the red outline, now being served by the Tri-County Electric Cooperative of Michigan.*



DIESEL AVIATION

*The grinding of spray profiles on nozzle valves for pintle nozzles is observed through a microscope at the American Bosch factory.*

# FUEL INJECTION EQUIPMENT FOR DIESEL AIRCRAFT ENGINES

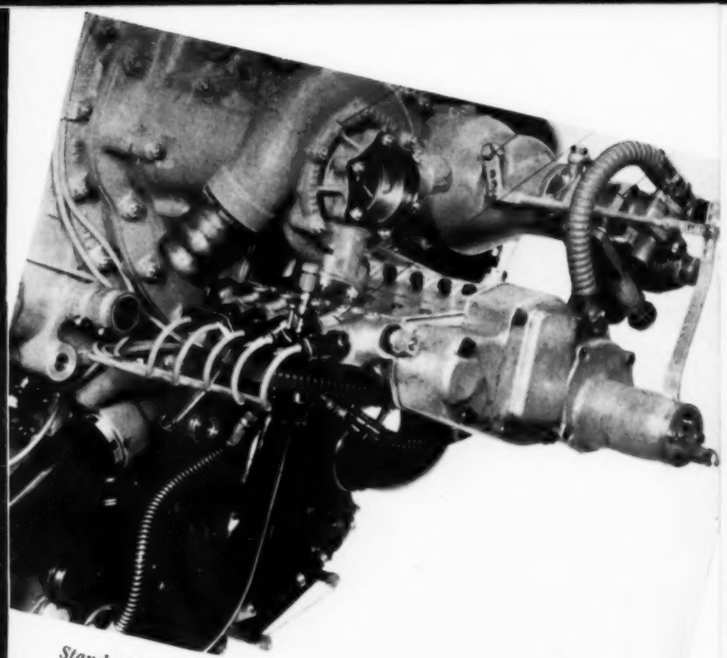
*By* PAUL H. WILKINSON

*SPRINGFIELD, Massachusetts, January 24.* During the writer's recent visit to Europe, it was apparent that fuel injection equipment was playing a very important part relative to the production of Diesel aircraft engines. In Germany, it was noticeable that standardized injection equipment was being used on their engines and that the latter were in quantity production. In France, on the other hand, no two designers were using the same equipment and none of their engines were even approaching the production stage. Now that we in the United States are starting to build Diesel aircraft engines, the writer has been enquiring as to what is available in the way of standardized injection equipment.

Here at Springfield, it was found that the American Bosch Corp. was working on various types of injection equipment for high-speed automotive, marine and industrial Diesels. After a tour of the factory and a study of the production methods used, it was evident that little change-over was required for the production of similar equipment for aircraft Diesels. Standardization was the keynote in this factory and the parts which they were producing could be serviced in any part of the World.

A short tour of the factory proved to be both

*Before American Bosch injection pumps are timed and calibrated, they are run in for one-half hour at the factory.*



*Standardized 9-unit Bosch injection pumps are used on B.M.W.-Lanova 114 V-4 Diesel aircraft engines produced in Germany.*

interesting and instructive. Regular flow-line production methods were in evidence and close inspection control was being maintained at all stages in manufacture. It was obvious that manufacturing was on a steady all-the-year-round basis and that a large investment had been made in machine tools many of which were automatic in their operation and of multiple capacity.

Some of the finest work was being done in the grinding and lapping department where plungers and barrels, nozzle bodies and their valves, and delivery valve bodies and their seats were being finished to very close limits. Here operations such as reaming, honing, grinding, rough and finished lapping, and hydraulic testing were being carried out on precision machines many of which were fitted with optical attachments. Several groups of Solex pneumatic testers were in use and on some of them, nozzle bodies were being inspected for straightness, roundness and taper of bore to within 0.001 mm.

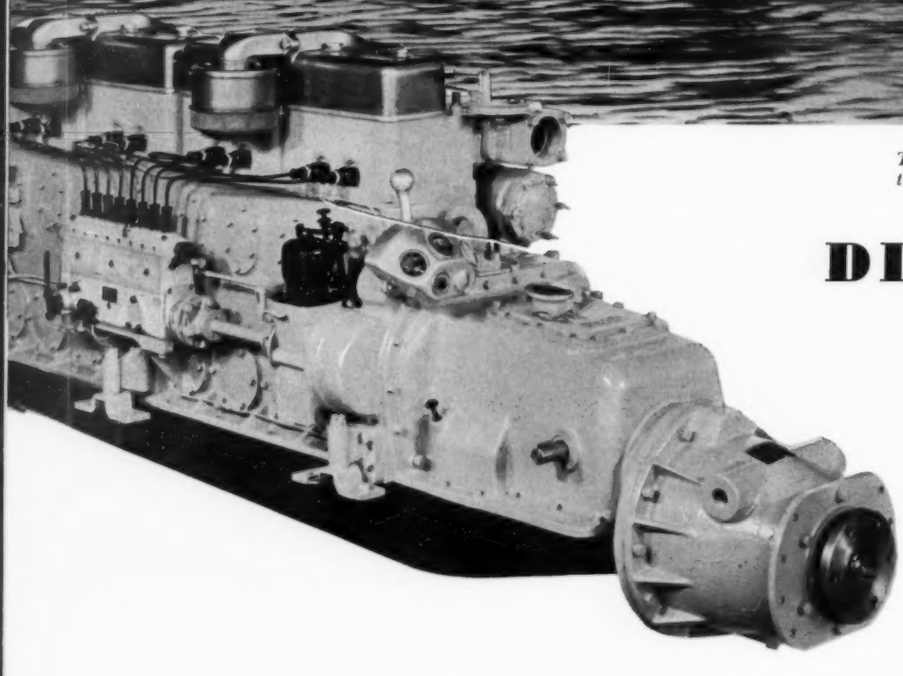
Production of nozzles, nozzle holders, transfer pumps and filters for high-speed Diesels was proceeding smoothly in this large factory having a floor area of more than 300,000 sq. ft. The flexibility of pump manufacture was particularly noticeable inasmuch as they were being turned out with capacities of from one to six outlets, as the pump units are called, without confusion in the production lines.

With regard to standardization, it was found that all American Bosch fuel injection equipment is produced to metric dimensions so that the parts are interchangeable with similar parts made by Robert Bosch in Germany, C.A.V.-Bosch in England and Lavalette-Bosch in France. The advantages accruing from such an arrangement are obvious when it is borne in mind that there are 47 service stations in the United States and Canada, and 66 more throughout the World, which are fully equipped for servicing American Bosch injection equipment.

Referring again to the status of the Diesel aircraft engine in Europe, standardization of injection equipment for these engines has been in vogue in Germany for a number of years. Engine builders have concentrated upon engine problems and fuel injection problems have been delegated to specialists in that field of endeavor. B.M.W.-Lanova Diesel aircraft engines are equipped with Bosch 9-unit, aircraft type injection pumps similar to those used on their fuel-injection gasoline aircraft engines. Standard 4-unit Bosch pumps are used on Mercedes-Benz Diesels built for airships with four pumps supplying the fuel to the sixteen cylinders of the engine. Junkers have used standardized pumps similar to the Bosch on thousands of their Diesel aircraft engines and undoubtedly will continue to do so in the future.

In France, as has been mentioned before, the opposite approach to the problem has been taken. Not one of the three designers whose engines have shown the most promise—Clerget, Coatalen and Jalbert—has used standardized injection equipment. This has resulted in delay and confusion of purpose, with time and money wasted on parts of the engines which could well have been built by manufacturers of injection equipment. That these enthusiasts should have their own ideas about fuel injection is, of course, commendable. Unfortunately, they have allowed their pet ideas to interfere with the development of their engines to such an extent that they are not even suitable for production.

In the United States, "Simplify and Standardize" should be the slogan of all proponents of the Diesel aircraft engine. Manufacturers of gasoline aircraft engines do not attempt to design and build their carburetors, magnetos and spark plugs. Why should designers of Diesel aircraft engines therefore build their own fuel injection equipment which will lack standardization when the time comes for servicing? It would seem that there are enough problems involved in completing an aircraft Diesel and getting it into production without adding the problem of fuel injection to the list.



*The Elco-57 Diesel Yacht "Bayram" and one of the pair of Superior Diesel propulsion engines.*

# DIESEL YACHT

## *Shipped to Egypt*

A SPECIALLY designed and constructed 57-foot Elco, has been shipped from the Elco Works, Bayonne, New Jersey, for delivery to Aly Bey Emine Yehia, well known young Egyptian industrialist, at Alexandria, Egypt.

The Diesel yacht, which is named *Bayram*, is powered with a pair of 150 hp. Superior Diesels. These are eight cylinder, 4½ in. bore, 5¾ in. stroke four cycle, solid injection engines, using American Bosch injection systems. Electric starting motors are Leece-Neville. The engines are mounted on Elco designed foundations consisting of steel girders set in rubber, which eliminate all vibration from the hull.

The layout is similar to that found in the 53-foot Elco Motor Yacht which formed part of the Radio Corporation of America's exhibit at the New York World's Fair, and which was described in the May, 1939, issue of DIESEL PROGRESS. The crew's quarters are located forward and a special hatch to the deck is provided so that it is possible for the crew to perform their tasks without interfering in any way with the activities of the owner's party.

Two single staterooms with hanging lockers and drawers are located just aft of the deck saloon. These are followed by the guests' lavatory on the starboard side and the owner's lavatory, equipped with a fresh water shower, to port. The owner's large double stateroom is equipped with every facility for comfort and convenience, including hanging lockers, bureau and drawers. Steps lead directly to the after cockpit where comfortable lounges and chairs are provided.

The controls, as on the 53-foot Motor Yacht, are located on the flying bridge, which gives perfect visibility. Due to the brilliant sun in Egypt, a permanent awning has been placed over the flying bridge of this boat to protect the helmsman. The additional length of four feet over the regular 53-foot Elco Motor Yacht has been distributed evenly throughout the boat.

Aly Bey Yehia is a director of a number of well-known Egyptian enterprises and is head of the Alexandria Navigation Company which has a fleet of six, nine thousand ton freighters. The order for the 57-foot Elco Motor Yacht was placed by Aly Bey Yehia during a visit to New York this summer to see the World's Fair.

# The Job You Want Done Is *Now* Being Done

with CUMMINS Dependable DIESELS


*for Example* This pair of 200 hp. supercharged Cummins Dependable Diesels power a Franks slim hole drilling rig operating near Eunice, N. M.

Less weight per horsepower makes the Cummins Diesel ideal for portable rigs. Its smooth running and quick acceleration is easy on the driller . . . the Cummins Diesel's operating economy, dependability and low maintenance cuts "out of pocket" costs to fractions.

These facts are consistently proved by experienced contractors in every active field. Ask Cummins Engine Company, 2516 Wilson Street, Columbus, Indiana.

## DIESEL EXPORT SHIPMENTS INCREASE

AMERICAN Diesel engine builders increased their export shipments last year to $3,124,679.00 which represents a slight advance over the corresponding trade in 1939 which totaled $3,097,915.00 – stationary and portable Diesels predominated, accounting for 78 per cent of the total exports in 1939, the remaining shipments consisting of marine Diesels. Russia was the best customer; Canada the second. The Philippine Islands took $267,877.00 worth of American Diesels in 1939. These figures do *not* include automotive Diesels exported in vehicles.



## GOULDS ANNOUNCES A NEW COMPLETE LUBRICATING OIL PURIFICATION SYSTEM

A COMPLETE lubricating oil purification system combining the advantages of centrifuging with the features of Fullers Earth filtration has been developed by Goulds Pumps, Inc., and the system is fully described in its new Bulletin 505, now ready for distribution.

The bulletin states that the Goulds Fullers Earth filters only are available for use in combination with existing centrifuge installations. The filter is described as being economical in cost of operation and easy to maintain, using Fullers Earth of a commercial grade and designed to permit emptying of one section at a time. A six-section filter, for example, can be completely refilled in a scant half hour.

Bulletin 505 gives Hydroil and Filter model numbers, capacities and prices of the complete units required for engines from 400 to 5,400 hp.

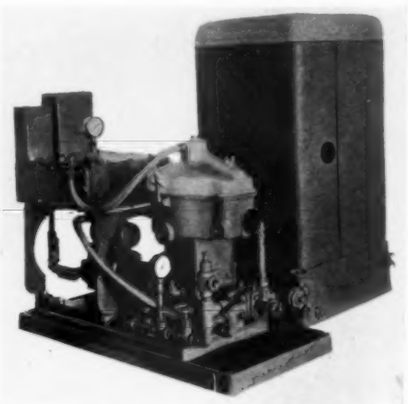
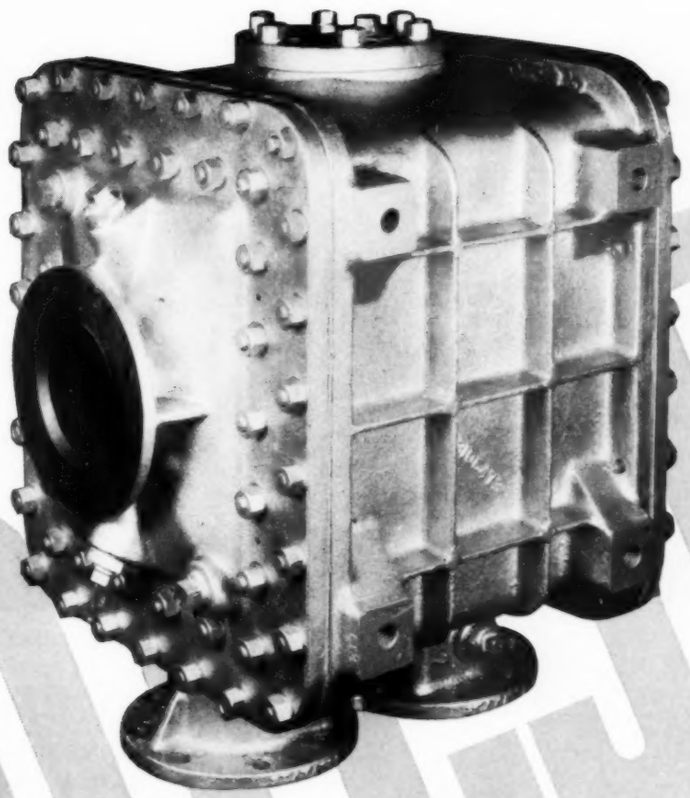


*Illustration shows the combination system using a "400" Series Goulds Hydroil centrifuge and a 4-section Goulds Fullers Earth Filter.*

The new system embodies a combination of the Goulds Hydroils Centrifuge with a newly developed Goulds Fullers Earth Filter. In operation the system functions first by rendering the oil mechanically clean by centrifuging at relatively high capacities, then by filtering to remove gums and other soluble contaminants, and finally centrifuging as a protection against migration of Fullers Earth. The system includes, in addition to Hydroil and Filter units, all piping valves, gauges and pump required for connection to the engine lubricating system and for operation of the two units in combination or separately.

It is suggested that our readers, who are interested, write to Goulds Pumps, Inc., Seneca Falls, N. Y., and ask for Bulletin No. 505.



DIESEL

# THE *Compact* OIL COOLER

HARRISON OIL COOLERS solve the space and weight problems of the Diesel engine builder.

These lightweight, sturdy units effectively maintain oil temperatures within the range required for best lubrication.

Their compactness saves valuable installation space and offers obvious advantages in inspection and cleaning.

Write for full information on both oil- and water-cooling units.

## *HARRISON*

**HEAT EXCHANGERS**
**FOR OIL AND WATER COOLING**

**HARRISON RADIATOR DIVISION • GENERAL MOTORS CORPORATION • LOCKPORT, N. Y.**

A NEW all-time world record for continuous railroad locomotive performance is believed to have been set on February 25 when Diesel-electric locomotive No. 56 pulled into Washington with the Capitol Limited of the Baltimore and Ohio Railroad. This arrival marked the 365th daily run of the locomotive between Chicago and Washington without a miss, for a total of more than 280,000 miles. So far as is known, no locomotive of any type ever before has established a record of 100 per cent availability in such gruelling service for a solid year.

The record is regarded as being the more remarkable because it was made on a 772 mile run calling for regularly scheduled average speed of more than 56 miles per hour — including ten regularly scheduled stops — over a route which includes some of the heaviest mountain grades in the Eastern section of the country. The Capitol Limited regularly consists of from eleven to as many as fifteen standard weight Pullman cars, ranking it with the heaviest fast schedule passenger trains in the country.

To make the 365 consecutive trips the locomotive had to pull the Capitol Limited between Washington and Chicago, with arrival in the morning and departure the same afternoon, day after day. This meant that the longest period during the entire year in which the locomotive was idle for servicing was six and a half hours.

Diesel Locomotive No. 56 is a 3,600 hp. unit built by Electro-Motive Corporation at La-Grange, Illinois, in 1938.



## CUMMINS BUILDS NEW RESEARCH AND TESTING LABORATORY

A NEW ultra modern laboratory and research building is rapidly being finished for Cummins Engine Company, Columbus, Indiana, well-known builders of automotive, marine and industrial full Diesel engines. The finished building now under construction by the Austin Company, Indianapolis, will be one of the most modern rigid frame "whale back" types built today.

This new structure will house five departments: metallurgical; chemical; engineering, record and supervision; machine and assembly; engine testing and development. Dimensions are 80' x 132' which give 10,600 square feet of floor space. The building itself will represent an estimated investment of over $75,000. The remaining $125,000 will go for the finest machinery available for testing and building engines and parts. Construction of this building follows closely upon the recent completion of a $400,000 ultra modern, daylight factory unit.

The new laboratory will give Cummins Engine Company's engineers and metallurgists a definite and extremely accurate check on the quality of and accuracy with which specifications have been followed in all metals used in any part whether built by Cummins Engine Company or contracted for.

The engineering, record, and supervision department will be in the front of the new building and will control the entire development organization. Records will give complete histories of all tests and analyses of problems.

The machine and assembly department will handle all machining of newly designed parts of any engine coming from the engineering department. The selection of machines to make experimental parts was given very careful consideration. Since no jigs or fixtures will be used and accuracy must be obtained in the machine, only the very finest precision tools were chosen. This department will be able to build a complete engine if necessary.

The engine test rooms are especially interesting. A total of six are being built in this division, all completely insulated and soundproofed. Ventilating fans will exhaust the air from each test room once a minute unless otherwise set. An additional unit is a wash and assembly room where parts removed from engines on test will be disassembled, washed, inspected and re-assembled, ready for test again.

The remainder of the rooms will mount the engines being tested. Between each room is a passage permitting observation of the engines while running. All instruments will be outside the rooms and it will not be necessary for the operator to enter the rooms while an engine is being tested.

MR. HAROLD G. SMITH has been appointed Chief Engineer of the Engine Division of the Buda Company, Harvey, Illinois, according to an announcement just released by Mr. R. K. Mangan, Vice-President. Mr. Smith has for several years been associated with the internal combustion engine industry.

Among other societies, Mr. Smith is a member of the A.S.M.E. and is also a member of the Engine Standards Committee of the Society of Automotive Engineers.

# A book on . . .

# DIESEL ENGINES

## by REX W. WADMAN

THE greatest living authority on the subject has written one of the most intensely interesting and informative books on DIESEL ENGINES ever to appear in print. A big book in every way, 10¼" wide, 13½" long, and 304 pages, beautifully illustrated and printed. Mr Wadman finished writing this book late last summer; we printed and published it last September. Written in that concise, easily understandable manner which characterizes all his writings, this BOOK ON DIESEL ENGINES contains a detailed description of one hundred and seven different and distinct Diesel engines. Each engine is taken apart for you; its features of design covered in detail; its methods of manufacture described for you with a clarity of expression never previously approached. This BOOK ON DIESEL ENGINES by Rex W. Wadman is a welding together of a wealth of experience, and a tremendous enthusiasm for the subject. Nothing like it published. The most useful Diesel book available, supplying, as it does, a complete cross section of the whole industry insofar as the engines available are concerned. The BOOK ON DIESEL ENGINES by Rex W. Wadman is of inestimable value to the Consulting Engineer; the Naval Architect; the Shipyard; the Diesel Salesman; the Diesel Designer; Prospective Diesel Engine Purchasers; and Diesel Engine Owners and Operators. A file cabinet, full of authentic, up-to-the-minute technical data on ALL available Diesel Engines: accurately, compactly compiled for YOUR benefit.

### DIESEL ENGINES DESCRIBED

Alco Four Cycle Stationary
Alco Universal Type
Alco-Sulzer "T" and "TM"
Allis-Chalmers
Atlas Imperial
Atlas-Lanova
Bristol "Phoenix" Diesel
Buckeye Diesel
Buda-Lanova Diesels
Busch-Sulzer Bros. 2-cycle
Busch-Sulzer Bros. 4-cycle
Caterpillar Industrial Engines
Caterpillar Marine Engines
Chicago Pneumatic Model 8-CP
Chicago Pneumatic Type RHB
Chicago Pneumatic RHB-100
Clark Bros. Diesels
Clerget Aviation Diesel
Coatalen Aviation Diesel
Cooper-Bessemer Type EN and GN
Cooper-Bessemer Type JTB
Cummins Diesels
De La Vergne Type VA
De La Vergne Model VB
De La Vergne Model VE
De La Vergne Model VG
De La Vergne Model VM
De La Vergne Gas Engines
De La Vergne Model VO
Deschamps Aircraft Diesel
Diesel Marine Auxiliary Units
Dodge Diesels
Enterprise Diesels
Fairbanks-Morse 33 and 37
Fairbanks-Morse Model 36-A
Fairbanks-Morse Model 36-A-8
Fairbanks-Morse Model 42-E
Fairbanks-Morse 32 and 35
Fairbanks-Morse Model 38
Fairbanks-Morse Model 46
General Motors Model 71
General Motors Model 567
Gray Marine Diesels
Guiberson Aviation Diesel
Hall-Scott "Chieftain"
Hamilton M.A.N. Engines
Hercules Diesels
Hill Diesels
Ingersoll Rand Type "S"
International Harvester
Junkers Jumo Diesel
Kahlenberg Engines
B.M.W. Lanova Diesel
Lister Small Stationary Diesels
Lorimer Diesels
Mack-Lanova Diesels
Mercedes-Benz
Murphy Diesels
Napier Culverin Diesel
Nordberg 4-cycle Diesels
Nordberg 2-cycle Diesels
Nordberg Gas-Diesels
Power Manufacturing Company
John Reiner Units
Ruston-Hornsby Horizontals
Sterling Crankless Diesel
Stover Single Cylinder Diesel
Superior Model "A"
Superior Model "D"
Superior Type M
Superior Type S
Titusville Iron Works
Venn-Severin Model "D"
Victor Horizontal Type
Washington Iron Works Diesels
Waukesha-Hesselman Type
Witte Types
Worthington Diesels
Yankee Diesel
Z.O.D. Aviation Diesels

### MAIL TODAY

DIESEL ENGINES, INC.—Two West Forty Fifth Street—New York City.

Enter my order for a copy of A BOOK ON DIESEL ENGINES by Rex W. Wadman, for which I enclose $3.00. I understand that the sub-title of this book is "Diesel Engine Catalog" and I further understand I can return the book to you, in good condition, within ten days of its receipt by me, for full credit, if it doesn't meet my requirements.

NAME _____

ADDRESS _____

_____

Please print name and address

## APPOINTMENTS BY AMERICAN BOSCH

*Foster N. Perry*

THE American Bosch Corporation has announced the appointment of Mr. Foster N. Perry as General Sales Manager with headquarters at Springfield. Mr. Perry is a member of the Society of Automotive Engineers and is well known throughout the Automotive and Diesel Industries.

Succeeding Mr. Perry, Mr. A. C. Altree, who has been with the Corporation for many years, having served as Sales Engineer at Springfield, San Francisco and Chicago, has been appointed Sales Manager of the Western division--with headquarters at Chicago.

The new branch offices at Cleveland and San Francisco will be in charge of the following men: Mr. Frank Oberle is being transferred from New York and will become Sales Manager of the Cleveland division. The San Francisco office will be under the direction of Mr. Maynard A. Fowler, Sales Manager of the Pacific Coast Division.

Additional changes in the sales organization include the appointment of Mr. Fred Behrens, currently Sales Engineer at Chicago, to the position of Service Manager—with headquarters at Springfield; and Mr. George H. Cherry, at present Sales Engineer at Detroit, to the new position of Sales Manager of the Canadian division.

## CUMMINS ENGINE COMPANY ANNOUNCES NEW WARRANTY

MARCH issues of trade publications covering the automotive, construction, material handling, petroleum, and lumber industries herald a new warranty policy announced this month by the Cummins Engine Company of Columbus, Indiana, manufacturers of Cummins Dependable Diesels. The warranty becomes effective March 1. Under the terms of the warranty, the company guarantees its Diesel for 100,000 miles or one year.

The Cummins Engine Company is the first Diesel engine builder to be able to offer such a warranty because this company pioneered the automotive Diesel, and is the only Diesel manufacturer with sufficient operating experience in the field to build an engine that can be safely guaranteed for 100,000 miles.

The engine backed by this warranty has been refined in many respects, as the result of the recent development of new precision manufacturing methods and improved materials to assure longer engine life and greater operating efficiency.

The warranty states in part that Cummins Diesels ". . . are warranted to be free from any defects in workmanship and material under normal use and service . . . within the first twelve months or the first 100,000 miles of operation, whichever shall first occur, from date of delivery of the engine to the original purchaser".

## AMERICAN LOCOMOTIVE COMPANY APPOINTS

DUNCAN W. FRASER was recently appointed President of the American Locomotive Company to succeed William C. Dickerman who was appointed Chairman of the Board at the same time. Both of these gentlemen reach their respective present positions after many years of service to the company.

Mr. Fraser served as Vice President starting in 1920. In 1924 he became a Director and in 1939 a member of the Executive Committee,

*William C. Dickerman*

*D. W. Fraser*

retaining his position as Vice President until Feb. 20, 1940 when he was appointed to the Presidency.

Mr. Dickerman came up throught the offices of General Sales Agent, Vice President in charge of all operations of the American Car & Foundry Company, and in 1928 was elected President of the American Locomotive Company. The latter position was held by Mr. Dickerman until his recent appointment as Chairman of the Board.

Other appointments announced by American Locomotive Co. are that of Robert B. McCall as Vice President-Manufacturing, directly from the Vice Presidency of the Alco Products Division of the Company, and that of Hugh M. Corrough as Manager of the Alco Products Division from the position of Manager-Engineering of the same Division.

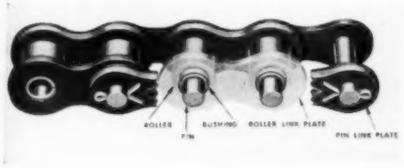
## DIAMOND CHAIN CELEBRATES 50TH ANNIVERSARY

"FIFTY years of doing one job well," which is being claimed by the Diamond Chain & Manufacturing Company of Indianapolis, might at first glance seem to indicate that the Company had failed to make very good use of its time. Spending fifty years on one job doesn't sound very aggressive. Yet when details are considered and when it is realized how many individual pieces are required to make just one foot of roller chain,—in one foot of single strand ⅜" Pitch chain, the shortest pitch made, there are 256 pieces; in one foot of twelve strand 1¼" Pitch chain, a medium pitch which is commonly used for a great variety of heavy duty drives, there are 960 pieces—the phrase begins to have meaning.

To illustrate one of the details take the development of the manufacture of a roller chain pin —apparently one of the simplest elements that can be found in any mechanism. This pin,

however, must meet a number of difficult requirements. It must be hard to resist wear, tough to withstand shock and strong in shear to produce tensile strength in the chain. It must be smooth to provide a wearing surface, accurate in size to hold the chain pitch within correct limits, and it must in no circumstances loosen up so that it will turn in the side links.

Fifty years ago these requirements were ingeniously (but inadequately) met by carburizing lengths of round material, cooling them slowly and then cutting the pins. In cutting the shoulder on each end of the pin, the high carbon surface was removed so that when the pin was heated and quenched, the body was hard and the ends soft so they could be riveted over. The next important development was a spinning operation that replaced the riveting and produced greater uniformity and better finish.




The introduction of alloy steels to replace the plain carbon steels came next. This increased the wear resistance and strength of the pin but produced a whole new series of problems. The very hard alloy steels were destructive to spinning tools and also made the press fit in the sideplate less effective. It was necessary to improve the manufacture of the sideplate hole into which the pin is pressed to restore the all important holding power. Reamed holes were developed together with automatic machines to produce them. Later, an even better technique was devised which shaved the holes in an operation similar to broaching.

As users steadily increased the speeds at which they operated chains, accuracy became more and more important and the bodies of the pins, which had formerly been satisfactory with a cold drawn surface, were now ground in centerless grinders. This was a substantial improvement, but it immediately indicated another necessary one. The pin head could not be ground and even with the most careful screw machine work, it was not as accurate as the pin body and it was impossible to make it exactly concentric with the pin body. This led to the use of the straight unshouldered pin on which the ends could be ground.

Meanwhile the character of the sideplate hole was so improved that the shoulder, which had formerly been necessary to maintain right assembly, was unnecessary. The spinning operation was supplanted by a simple pressure upsetting since there had been developed a method for drawing the temper of the pin ends so that a small amount of material could be displaced.

During this entire period new materials were constantly coming on the market and all of them had to be tried so that advantage could be taken of progress in the steel industry. New heat treating methods were necessarily the subject of laboratory and shop experiment. With every step automatic machinery had to be designed and built,—and tools invented, tried out and scrapped or continued.

Viewed in the light of this sort of history, it is easy to see that those "fifty years" were very busy ones. When so much had to be done for such a simple thing as a chain pin and when simultaneous development had to be carried on for hundreds of other chain parts, it almost seems that "doing one job" is an understatement.

# OVER 2500 INVITED GUESTS ENJOYED ANOTHER H.O. PENN 'GET-TOGETHER'



MORE than 2,500 invited guests attended the H. O. Penn "Get Together" Machinery Show last month. Included in this turnout were many city, county and state highway officials, engineers, builders, contractors, operators, industrial plant owners and managers, as well as a surprising number of seamen, the latter intensely interested in conversion to heavy duty and low cost marine Diesel motive power.

This was by far the largest gathering ever known to attend an independent show anywhere and sets a record that will probably stand for many years to come. The show was a "natural" with a wide range of equipment never before gathered together under one independent roof. The Penn Showroom at 140th St. and the East River, New York, is said to be the largest distributor headquarters in the country with more than 25,000 square feet devoted to the show. High ceilings of the showroom allowed ample space for inside operation of the Marion and Speeder Shovels. Huge LeTourneau scrapers, a dozen Caterpillar Diesel tractors equipped with LaPlant-Choate bulldozers in that many sizes, and the tremendous Caterpillar No. 12 Diesel Motor Grader with power control blade, scarifier and "V" type Snow Plow.

And what a show! The auditorium with 350 seats was filled to capacity all afternoon and evening. Continuous talking movies of outstanding educational value were shown. Some featured the many new uses of Diesel engines and the ever-increasing wide-spread use of the low cost Caterpillar Diesel motive power including simple electric generator sets, marine units and complete all inclusive public utility plants. The "Get Together' was scheduled from 4 P. M. to 11 P. M. according to the tickets but the crowds began filing in shortly after 12 noon and it was past midnight before the hosts had time to think of curfew.

On behalf of our readers who attended this show we extend a vote of appreciation to the entire H. O. Penn organization who displayed a spirit of cooperation and conviviality that was good to see. Mr. H. O. Penn is well-known as one of the grand old guard of the equipment industry, but this was no one man show! Jack Frost, Ralph Johnson, Stu Wade, Art Ketcham, Brudd Olin, and Harriet Plotkin (leading lady

of the equipment stage) were very much in evidence via constructive planning and all around courteous helpfulness to guests. Pete Ruggles was busy every minute of the many hours explaining the engineering principles bound up in Caterpillar marine power and electric generator installations.

Caterpillar was represented by territorial manager Bill Zeigler, New York manager, George Churchill and a half dozen service representatives including the men responsible for the famous Caterpillar Road Show which was staged as one of the Penn exhibits.

Next to the auditorium, a space was set aside for display of various equipment rebuilt by Penn. Perhaps the only difficulty of the show was encountered here where the Penn representatives found it difficult to convince guests that this equipment was not new. It all looked brand new. Wearing parts, where buyers look first, had been replaced by new parts. There seemed mighty little difference between the new machinery and the Penn rebuilt line, and guests were advised that all equipment rebuilt in any of the three Penn plants (New York, Mineola, Poughkeepsie) is guaranteed. The only apparent difference was in the price!

The H. O. Penn Machinery Co. was established in 1921 and the business has grown steadily year after year through periods of depression and panic until now it is one of the largest distributing and servicing organizations in the world, with three plants cooperating but independently operated. The company is staffed by many of the industries' leading figures and is headed by Hamilton O. Penn, a name that is favorably known throughout the country. The Penn organization acts as exclusive territorial representative for many nationally known products including Caterpillar Tractors, Marine Engines, Power Units, Marion Shovels, LeTourneau Scrapers, Athey Wagons, LaPlant-Choate Bulldozers, Huber Rollers, Foote Pavers, Smith Mixers, Heltzel Bins and Forms, Marlow Pumps.

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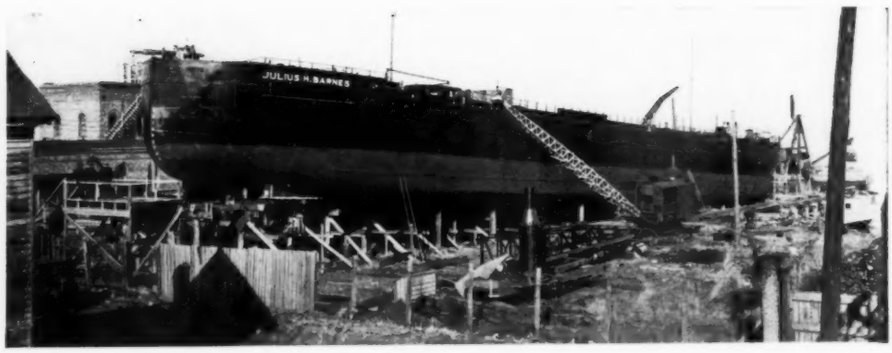
To answer a continuing demand for larger self-contained Caterpillar Diesel-Electric Sets, Caterpillar Tractor Co. has added a 66-kilowatt and a 52-kilowatt unit to its line.

The two new sets, the 11-52 and the 13-66, are completely self contained, and require no gadgets other than a circuit breaker. Both are powered by six-cylinder, heavy-duty Diesel engines; and both require a minimum of maintenance and adjustments. As with the smaller sets, they can be set up and running within an hour after delivery.




## LARGEST ALL-WELDED DIESEL SHIP LAUNCHED

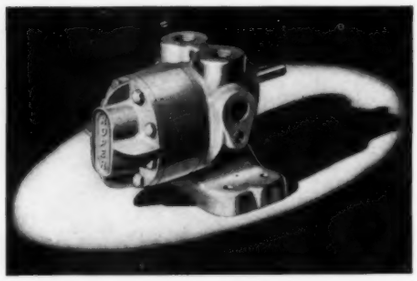
THE largest all-welded steel hull ever built and the largest craft ever constructed by the Charleston Shipbuilding and Drydock Company was christened *Julius H. Barnes* and launched February 27. This 1,850 gross ton Diesel ship is 300 feet long, 42 feet wide and 18 feet deep and has a cargo capacity of 3,000 tons of miscellaneous freight in five holds.

Built under the auspices of the United States Maritime Commission, the *Julius H. Barnes* is the first ship constructed under the Maritime building program for Great Lakes and coastwise service. The vessel is to carry general cargo through the Erie Canal and the Great Lakes during the months these waterways are open for navigation. When the Lakes and Canal are closed by winter ice, she will operate coastwise. She was named for the president of the Erie and St. Laurence Corporation of New York and past president of the United States Chamber of Commerce.

The main propulsion engines installed prior to the launching are two 450 hp., 360 rpm. Fairbanks-Morse Diesels of 5 cylinders each, 12 in. bore, 15 in. stroke. Two F-M generators, one 60 kw. and one 40 kw. supply the ships electrical requirements. The main engines are fitted with Maxim intake silencers and Vortex exhaust spark arrester silencers. The exhaust pyrometers are Alnor. Andale Duplex basket type filters are fitted to both fuel and lube oil systems. The lube oil coolers are Schutte & Koerting and the heat exchangers in the jacket cooling system are the same make. A Goulds Hydroil is installed for all lube oil reclamation. Erie Forge Company supplied the forged propeller shafts.

**DIESEL PROGRESS**

A NEW line of Roper rotary pumps has just been announced by the Geo. D. Roper Corporation.



Containing over 7,000 different units, this new line includes pumps of 1, 3, 5, 10, 15, 20, 35, 50, 75, 100, 150, 200, 300, 500, 750 and 1000 gpm. capacities at speeds up to 1,800 rpm. and against pressures up to 1,000 lbs. per square inch. At present 21 different drives and mountings are available ranging from ordinary foot, hub and flange mounting heads to complete bedplate units for direct motor drive; gear reduction; flat or V-belt drive.

An outstanding feature of this new line is "hydraulic balance." It equalizes internal pressure at all points and absorbs all shock or thrust from power end of drive shaft.

Other features include your choice of spiral, spur or herringbone gears; conventional packing box, spring loaded packing box or mechanical seal; sleeve or roller bearings; built-in or external relief valve; eight different piping arrangements.

## COOPER-BESSEMER OPENS NEW ST. LOUIS OFFICES, HEADED BY W. S. ARTHUR

TOGETHER with the announcement that the Cooper-Bessemer Corporation has established sales offices in St. Louis, Missouri, comes word that W. S. Arthur has joined that company and will manage sales engineering activities in the districts served by the new branch.

Mr. Arthur joins Cooper-Bessemer with a fine background of experience in the machinery building and sales fields. In his position as manager of Cooper-Bessemer's new St. Louis office, Mr. Arthur will further sales of the company's Diesel engines for both marine and stationary services, those engines ranging in size and type from 75 to 1,100 hp.

The new Cooper-Bessemer offices are located on the fifteenth floor of the Arcade Building, at Eighth and Olive Streets, in the heart of St. Louis. Territory covered by this branch sales office will include the larger part of Missouri, southern Illinois, northeastern Arkansas, and Mississippi as far south as Greenville.







IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR